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# The Morris Worm ‡

Kit Tiyapan †

$30^{th}$ October 1996

In 1988 a piece of 99 lines of code written by a 23 year-old Ph.D. student in Computer Science at Cornell University, Robert T. Morris, had crippled a large number of computers connected to the Internet. At 6 pm $2^{nd}$ November 1988 , a worm was set loose by its author. Within less than five hour's time from the launch, computers across US had to be shut down. At the time when Andy Sudduth at Harvard posted a message saying that *there may be a virus loose on the Internet*, the Internet was already coming apart. All the computers affected were not able to come up again until all the working worms had been removed from the Internet, which was four days later. The programme, which has been known afterward as the Morris Worm, had forced more than 6,000 workstations, all of which were VAX and Sun machines, to be shut down. The estimated loss was thought to easily reach several million US dollars. It was claimed by Morris, afterward, that the effect from the code was meant to be much milder but for some small bugs within it. As a result, the whole of the Internet community was shaken.

In contrast to a virus which mainly spreads itself via infected disks, a worm goes via the Internet. A virus alters a file and waits for the file to be activated by a user. A worm, on the other hand, acts on its own and is far more aggressive than a virus. Take the Morris worm as an example. It protects itself, seeks and stores information it needs, searches for victims and then attacks them, reports its progress, balances the situation and makes decisions accordingly, and even destroys evidences and commits suicide. Moreover, the worm has got its own built in dictionary of words to be used in cracking passwords. To put in plain words, a worm is a killer robot while a virus a parasite.

During the worm attack there were efforts trying to decompile the programme in order to find remedy. Among these were those made

‡ First published in a Thai translation under the title '*Nhạun khạung Mạurris*', Sakkayaphab, **4**, 3, 20–22, December 1996, ATPIJ, Japan. It was originally written in English, the present article.

† This article was written while the author was at Tokyo Institute of Technology.

by the teams at the University of California at Berkeley, MIT, and at Purdue. Within less than 24 hours the team at Berkeley and the team at Purdue had found methods to slow down the spread of the worm. Ironically, not being less panicked at the fast spread of the worm was its author himself. Morris had contacted his friend at Harvard. They discussed a solution and eventually came up with one. Unfortunately the messages sent by these teams and others to tell about the remedies could not reach some of the affected sites as fast as they should have. This was because of the clogging of the networks. Also, at many of the sites the mail facility was shut down after the discovery that the worm spread via `sendmail`. Thus the message about the remedy were even further delayed.

Since the happening, the Internet community has become much more aware of the importance of the security of their networks and systems. Within the same month of which the worm had appeared, an organisation was formed in response to the incident. It was called CERT, which stands for *Computer Emergency Response Team*.

One of the interesting facts is that most of the computer viruses and worms that ever were, came from the academics. It is widely believed, at least within community of people who see the importance of security in computer systems, that the cases of these so-called *white-collar* crimes must be much higher than what we have heard. Many of the cases discovered are believed to have been covered up, and dealt with internally, in order to keep the good image which many companies have got, especially financial institutions and government authorities. Others simply goes undetected. The irony in this is that while the money involved increases exponentially in relation to the cases of its counterpart which are known as the *blue-collar* crimes, the risk of being caught is comparatively small.

The field of computer and networks security is one which comprises of two main parties, those who try to prevent on on side, and those who try to infringe on the other. As the technology leaps forward the way it is now, both parties will find it hard already only to keep abreast with new products and to catch up with new methods used by the other party. Though the preventors seem to be better manned and better equipped, it has got a difficulty of having to deal with enemies who are in the dark. Also security does not come at no cost. On top of the cost of hardwares, softwares and personnel, there is also an inevitable trade-off between convenience of the users and the security of the systems. In other words, though in theory it might be true to say that the more secure the system is the better. But in reality it

all depends upon the consideration about the costs against the risks involved.

§ **Miscellaneous facts**

The Morris worm made use of `finger` command. This is one of the reason why many sites now block inbound `finger`ing requests.

The file `/etc/passwd` is world-readable. The security loop-hole of storing encrypted passwords in this file has been used by the worm.

The use of the `.rhosts` file can also post a risk to security. This fact has been exploited by the worm.

And lastly, as a quotation before ending,

> Robert T. Moris was convicted of violating the computer Fraud and Abuse Act (Title 18), and sentenced to three years of probation, 400 hours of community service, a fine of $ 10,050, and the costs of his supervision. His appeal, filed in December, 1990, was rejected the following March.
>
> *Zen and the Art of the Internet*, by Brendan P. Kehoe

# SPT Daiy

Kit Tyabandha, Ph.D.

## Introduction

The works that go into this article were done during the year 2002 while the author was at the then University of Manchester Institute of Science and Technology, England. The system Sanskrit-Pinyin-Tiyapan (SPT), as the name implies, is based on the romanisation of Sanskrit for consonants, the tone symbols for tones, and an added part for specific features of Thai (Daiy) by Tiyapan.

## SPT Daiy

**Definition 1.** There are 44 consonants in the Thai alphabet, namely,

| | *voiceless* | | | | *voiced* | | | | *voiceless* | | *voiced* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *una* | *asp* | *una* | *asp* | *una* | *una* | *asp* | *una* | | | | |
| *vel* | | k | kh | ḳh | g | g̣ | gh | ng | (w) | h | ḥ | |
| *pre* | | c | ch | | j | z | jh | ẏ | ś | | y | |
| *ret* | ḍ́ | ṭ | ṭh | | ḍ | | ḍh | ṇ | ṣ | | r | ḷ |
| *den* | ḍ | t | th | | d | | dh | n | s | | l | |
| *lab* | ḅ | p | ph | fh | b | f | bh | m | | | v [w] | |

where the abbreviations are, asp, aspirated; den, dental; lab, labial; pre, pre-palatal; ret, retroflex; una, unaspirated; and vel, velar.

§

When a syllable following another syllable and has no initial consonant ($c_1$), '*w*' is added in place of the missing $c_1$ to aid syllabic separation. The consonant *v* when occurred as $c_2$ is changed into *w*.

**Note 1.** Compare Thai alphabet in Definition 1 with the $5 \times 5$ character matrix of Sanskrit.

| | | | | |
|---|---|---|---|---|
| k | kh | g | gh | ṅ |
| c | ch | j | jh | ñ |
| ṭ | ṭh | ḍ | ḍh | ṇ |
| t | th | d | dh | n |
| p | ph | b | bh | m |

§

Thai consonants are divided into three groups, namely *middle, high* and *low* consonants, according to whether the tonal sound of their phonemes with long vowels is the first (neutral) or the fifth (high) tone.

**Definition 2.** Middle consonants are *b̥, c, d́, d̥́, k, p, w, t, t̥*.

§

**Definition 3.** High consonants are *ch, fh, h, kh, ph, s, s̥, ś, th, t̥h*.

§

**Definition 4.** Low consonants are *b, bh, d, dh, d̥, d̥h, f, g, g̣, h̥, j, jh, z*.

§

**Definition 5.** The rest of the consonants, namely *l, l̥, m, n, n̥, ng, r, v, y, y̰* are called *sonorants*.

§

All sonorants have low tone which become high when combined with *h* to form *lh, mh, nh, ngh, vh, yh, y̰h*.

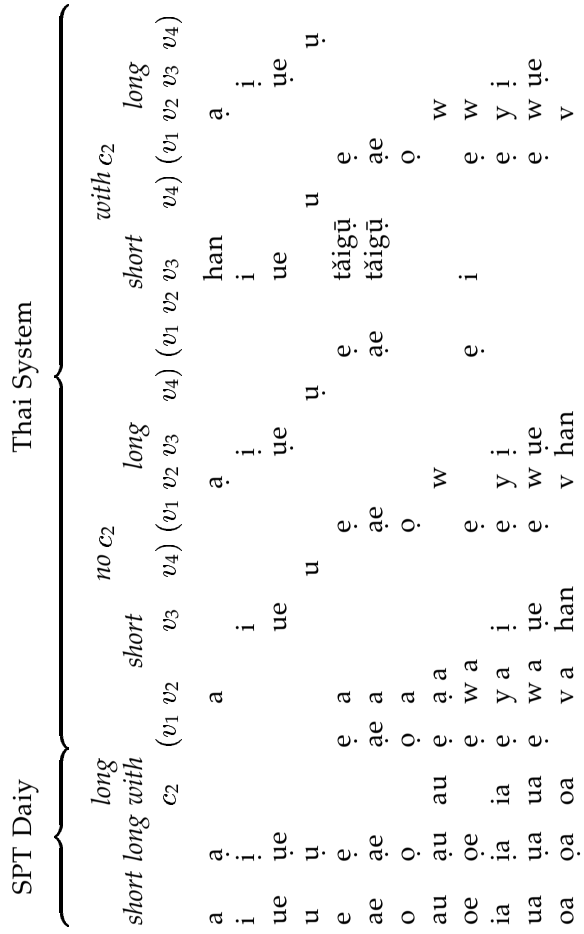
**Definition 6.** For any syllable let $c_1$ be the initial consonant, that is one which comes before the vowel, $c_2$ the final consonant, that which comes after the same. Let $v$ be the vowel of the syllable considered.

§

In Thai alphabet, too, $c_2$ always occurs at the end, but the vowels may surround $c_1$ on the four sides, ie left, right, above and below,

$$\begin{array}{ccccc} & v_3 & & & \\ v_1 & c_1 & v_2 & c_2, & \\ & v_4 & & & \end{array}$$

where $\bigcup_{i=1}^{4} v_i = v$. The Thai symbols used for vowel are *a, a̤, (māi) han, i, i̤, ue, ṳe, u, ṳ, e̤, (māi) tăigū, a̤e, o̤, w, y* and *v*. Four short vowels, namely *am̤*, *ai*, *ai̤* and *ao*, inherently come with a final consonant, respectively *m, y, y* and *v*, so they never have a $c_2$. Finally $c_1\dot{a}v(c_2)$ is the same as $c_1v(c_2)$ except when $v_1$ is present.


Thai System
SPT Daiy
short long long with c2 (v1 v2 v3 v4)
short (v1 v2 v3 v4)
long (v1 v2 v3 v4)
short with c2 (v1 v2 v3 v4)
long with c2 (v1 v2 v3 v4)
a ạ a ạ
i ị i ị
ue ụe ue ụe
u ụ u ụ
e ẹ e ẹ a ẹ ẹ ạ
ae ạe ae ạe a ạe ạe
o ọ ọ a ọ ọ
au ạu au ẹ ạ a w ẹ
oe ọe ẹ w a ẹ ẹ
ia ịa ia ẹ y a ị ẹ y ị
ua ụa ua ẹ w a ụe ẹ w ụe
oa ọa oa v a ḥan v ḥan
tǎigū tǎigū
tải gū tải gū

**Definition 7.** There are five *tonal sounds*, namely *common, first, second, third, fourth*. There are four[tonal symbols], that is to say, *first, second, third* and *fourth*, the common or neutral sound needing none. The tone symbols are written respectively as ˇ, ̀, ̄, ́.

§

| | *no final alphabet* | | *final alphabet* | | | |
|---|---|---|---|---|---|---|
| | | | *live* | | *dead* | |
| *initial consonant* | *long vowel* | *short vowel* | *long vowel* | *short vowel* | *long vowel* | *short vowel* |
| *low* | 023 | 23 | 023 | 023 | 23 | 3 |
| *middle* | 01234 | 123 | 01234 | 01234 | 123 | 13 |
| *high* | 124 | 1 | 124 | 124 | 1 | 1 |

**Table 2** *Tone table*

Lastly, the *karanta* is represented by a dot placed over the unvowel-eled consonant. The vowel thus removed is left trailing behind for identification purpose. Examples are *bandha* (bond) and *bandhu* (lineage) both of which are a common suffix found in Thai family names.

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# Thai Culture

by Kit Tyabandha

February 2004

## Introduction

In Sanskrit *śyāma* means *black*, and *ksyaḥ* a house or abode. The latter also means end or termination. Whether these words are related to *Siam* one may never know. The word was first spelt this way by James Lancaster in 1592. *Shan* is the same as *Siam*.

On the other hand, the name *Siam* could have had its origin from the name *Ayudhya*. *Śrị Ayudhyạ* according to the rule of *sandhi* becomes *Śryayudhyạ*, which is pronounced as '*Siayudhyạ*'. This according to the usual practice is reduced into one syllable in Chinese, 'Siam'.

Figure's 1 – 6 show the boundaries of different periods of Thai kingdom.

## History

Dvaravati kingdom lasted until the 11$^{th}$ or the 12$^{th}$ century. Nàncào kingdom (650–1250) existed in what is nowadays Yunnan and Sichuan in China. Sukhọdaï (Sukhothai) kindom lasted from 1238 until 1376, Lanna from 1296 to 1558, Ayudhyạ from the 14$^{th}$ century until 1765.

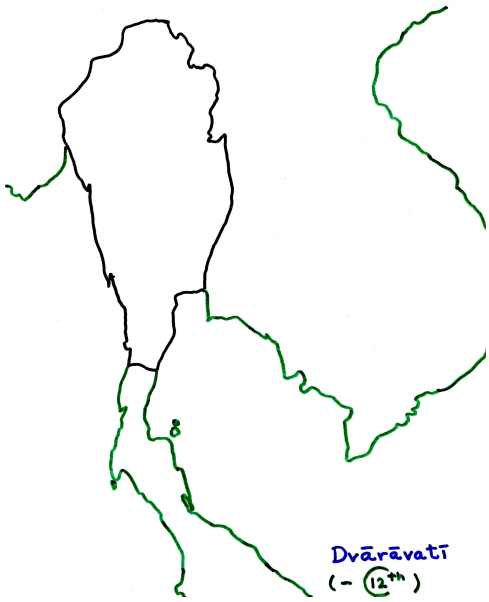


**Figure 1** *Dvārāvatī*

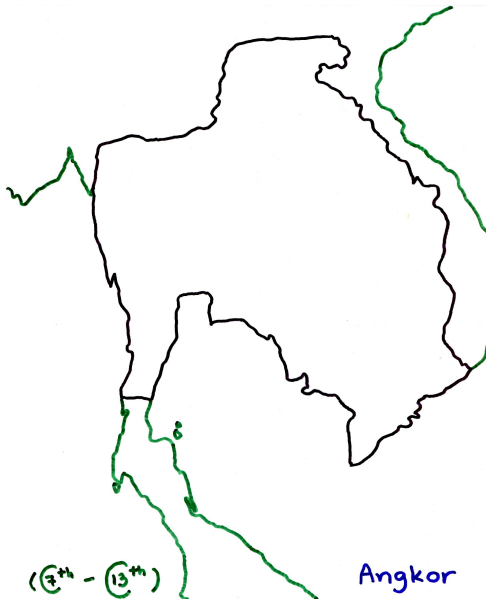


**Figure 2** *Angkor*

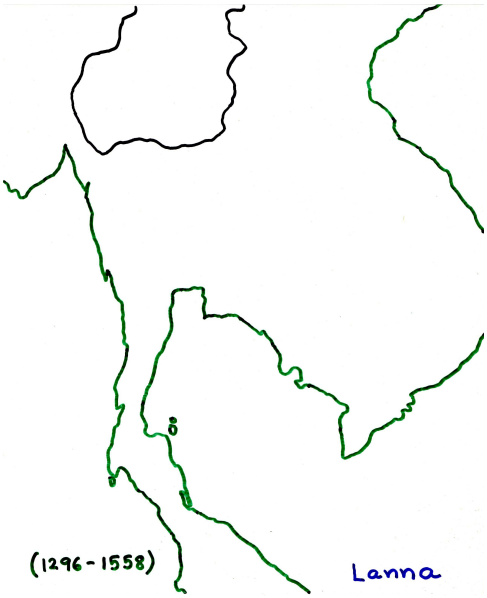


**Figure 3** *Lanna*

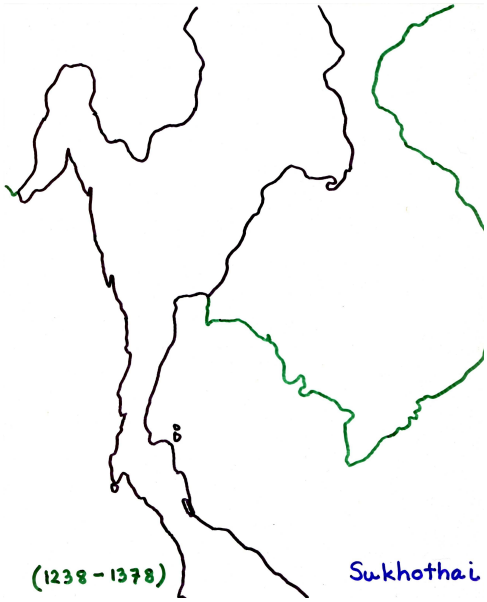


**Figure 4** *Sukhṓdaï*

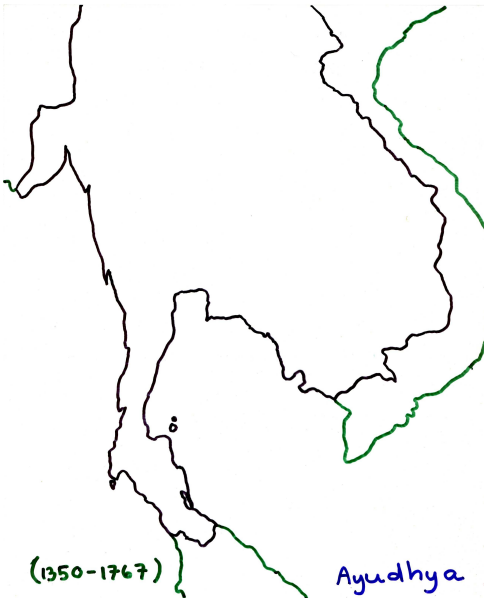


**Figure 5** *Ayudhyạ*

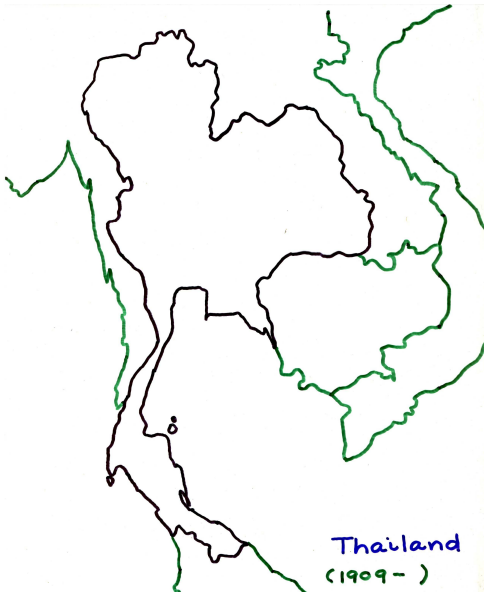


**Figure 6** *Thailand*

Table 1 shows all the kings of the Cakrị dynasty who reign over

Bangkok and Thailand until the present day. The king no longer wield the ruling power.

| *King* | *Life* | *Reign* | *English name* | *Thai name* |
|---|---|---|---|---|
| Rāmā I | 1736 – 1809 | 1782 – 1809 | Yod Fa | Buddhàyaudfācu' .aḷok |
| Rāmā II | 1767 – 1824 | 1809 – 1824 | Loet La | Buddhàloeślhàṇàbhaḷay |
| Rāmā III | 1787 – 1851 | 1824 – 1851 | Nang Klao | Nàngklàocàoywŭḥọa |
| Rāmā IV | 1804 – 1868 | 1851 – 1868 | Mongkut | Caumklàocàoywŭḥọa |
| Rāmā V | 1853 – 1910 | 1868 – 1910 | Chulalongkorn | Culàcaumklàocàoywŭḥọa |
| Rāmā VI | 1880 – 1925 | 1910 – 1925 | Vajiravudh | Mongkutklàocàoywŭḥọa |
| Rāmā VII | 1893 – 1941 | 1925 – 1935 | Prajadhipok | Pokklàocàoywŭḥọa |
| Rāmā VIII | 1925 –1946 | 1935 – 1946 | Ananda Mahidol | Ànandàmàhidól |
| Rāmā IX | 1927 – | 1946 – | Bhumibol Adulyadej | Bhụmibolàdúlyadèj |

## Thai language

The present Thai alphabet bear the strongest influence from Khmer during the Ayudhya period. Lanna (now Chiangmai) and Lanjang (or

Lanchang, now in Laos) had a different alphabet which has the resemblances to old Burmese alphabet.

## Thai food

Curry dishes: *kạeng kăi*, *kạeng karhĭ*, *kạeng masa̲măn*, *kạeng nūa*, *kạeng plạ́uk*, *kạeng sòm*, *banạeng kăi*, *tòmkhă̆ kă̆*.

Soup: *kạeng cụeá* (*vūnsèn*), *kạeng liang*, *khàwtòm* (kùng, mhụ, plạ], *tòm glō̜ng*, *tòm yaṃ*,

Egg dishes: *khăi balō̜*, *khăi ciaw* (khăi fụ), *khăi ciaw mhụsaḅ*, *khăi ạ́aw*, *khăi gem*, *khăi loak*, *khăi lụkkhoeï*, *khăi tòm*, *khăi tún*, *khăi yaá sàị*,

Fried dishes: *dauá man* (*kùng*, *plạ*), *kăi phaá meá mamòang*, *khàw phaá*, (*kùng*, *mhụ*, *nūa*) *phaá nāṃmanhauï*, *paupīa dauá*, *phaá mhĭkrauḅ*, *phaá brik* (*kăi*, *mhụ*), *phaá ạ́auk kalhăṃ*, *phaá phakḅùng*, *phaá prìawvhạn*, *plạ dauá saṃros*.

Others: *blà kùng*, *hă̆umhok plạ*, *hụ chlạm săị pụ*, *kăi* (*dauá*, *yàng*), *kăi hă̆u ḅaịtoeï*, *kàmpụ* (*dauá*, *nùeng*), *khàwman sòmtaṃ*, *khàwtang nhàtàng*, *khnompang nhà mhụ*, *kùng dauákrauḅ*, *kùng oḅ vūnsèn*, *kùng phao*, *laḅ*, *nāṃbrik kapi*, *peá tún*, *plạ dauá*, *plạ kabongkhạw nùeng manạw*, *plạ nāṃkhạw*, *plạ prìawvhạn*, *plạsaṃlị ạ́aeá́diaw*, *pụcạ́*, *sa̲laá nūasan*, *sòmtaṃ*, soup *khàwboḍ́*, *yaṃ* (*nūa*, *plạmhuek*), *yaṃ plạ krauḅ*, *yaṃ thŏablụ*, *yaṃ vūnsèn*,

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## Appendix

## Sanskrit – Pīnyīn – Tiyapan romanisation of the Thai alphabet

The Thai alphabet used here follow the SPT system introduced by Tiyapan (2003). There are 44 letters of which two are now obsolete,

namely ḳh and g̣. The remaining 42 characters based on Sanskrit are listed in Table 2. When *w* is the $c_2$-form of *v* it always follows a vowel and never precedes it; when it is an *ạu ặng* (*ạuwặng*) it is used only to separate two different vowels, and never elsewhere. The definition of $c_2$ is give below.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | k | kh | | g | | gh | ng |
| | c | ch | | j | z | jh | y̰ |
| ḍ́ | ṭ | ṭh | | ḍ | | ḍh | ṇ |
| d́ | t | th | | d | | dh | n |
| ḅ | p | ph | fh | b | f | bh | m |

y r l v [w] ś ṣ s h Í (w) ḥ

**Table 2** *Thai alphabet in SPT system (Tiyapan, 2003)*

The tone symbols based on Pīnyīn system of Chinese are

ka̰ ka̍ kà̰ kā ká.

In Chinese the ordering is slightly different, that is

kā ká ka̍ kà.

In Chinese the *a* vowel is always long, and there is nothing equivalent to the Thai *sạmañ* (neutral) tone.

Table 3 gives all Thai vowels both long and short, with and without a *s<u>a</u>koḍ́* (final) consonant. The *tòn* (main) and *s<u>a</u>koḍ́* consonants are here represented by respectively $c_1$ and $c_2$. In SPT a syllable is always in the form of $c_1vc_2$ or $c_1v$ depending on whether or not $c_2$ exists.

| **short** | **long** | **long with $c_2$** |
|---|---|---|
| a | a̤ | |
| i | i̤ | |
| ue | ṳe | |
| u | ṳ | |
| e | e̤ | |
| ae | a̤e | |
| o | o̤ | |
| au | a̤u | au |
| oe | o̤e | |
| ia | i̤a | ia |
| ua | ṳa | ua |
| oa | o̤a | oa |
| am̤ | | |
| ai | | |
| ai̤ | | |
| ao | | |

**Table 3** *Thai vowels in SPT system (Tiyapan, 2003)*

# English and American

Kit Tyabandha, Ph.D.

The Words section titled contains different words used in American and English for the same meaning while the False Friend section contains the same words that carry different meanings in the two languages. In other words, the Words chapter is oriented around the meanings whereas the False Friend section around the words.

## False Friend

*bus* means only the omnibus which operates a short-distant service, that is to say, within a city or a town (UK); but both bus and coach (US).

*Franchise* means in politics the eligibility, right, or privilege to vote at public elections (UK); but a special right given by public authorities to a person or company (US).

## Words

*Accelerator* is the `gas pedal`. The *accumulator* of a car is the `generator`. Tne *American football* is simply the `football`. *Autumn* is known as `Fall`.

*Bonnet* is a `hood`. The *boot* of a car is called `trunk`.

*Cancelled* is written `canceled`. `Carrousel` is *carousel*. The UK prefers the suffixes which end with *~ce* whereas the US those with *~se*. For example, *licence* – `license` and *practice* – `practise`. *Chilli* over there is `chili`. `Crenelated` is *crenellated*.

In a car, a *dynamo* is a `battery`. *Defence* is written as `defense`.

The *epaulette* is called `epaulet`.

`Feisty` is used only in American. It means *excited* or *quarrelsome*, and has its origin in *feist*, a dialectal word for *fist* Used also in NZ.

*Fenders* are `bumpers`. A *flat* is called an `apartment`, while the *block of flats* the `apartment house` and *service flats* are but an *apartment hotel*. No *football*, but `soccer`! Ancestors are *forbears*, or `forebears`.

The *gear lever* is called the `gear shift`. *Gobbledygook*, a pompous nonsense, is written `gobbledegook` and means pretentious and obscure speech or writing. In the UK you conjugate 'to get' as *get – got – got* whereas in the US it is `get – got – gotten`.

The *halls* at the entrance of a station are called `concourses`.

The *indicator light* is called either the `left-turn light` or the `right-turn light`. The *indicator switch*, which is used for starting the engine, is called the `turn signal`. *Instalment* sometimes means `installment`.

`Labor` is *labour*. *Leucotomy* is the same as `lobotomy`; both are the treatment which involve cutting into brain tissue to correct some mental disorders. A *licence* becomes a `license`.

`Marvellous` is reduced to mere *marvelous*. The unit of length *metre* is `meter`. In other words, '*A meter is not a metre long*'. A *mould* is called a `mold`.

The *number plate* of a car is over there the `license plate`.

*Pavement* becomes a `sidewalk`. *Per cent* is written *percent*. *Petrol* is called `gasoline` or `gas`. *Petrol tank* is the `gas tank`. The verb *practise* is `practice`. *Pub* is a `saloon`. But when it comes to the *saloon-car* the US call it a `sedan`. At the rear end of most saloon-car there is a *boot* or `trunk`.

The *rear light* is the `taillight`. The *registration number* of a car becomes the `license number`. The `roller-coaster` is in fact a *switchback*.

A *saloon car* is in the US a `sedan`. The *silencer* of a car is called the `muffler`. *Skilful* is `skillful`. *Sparking plug* is the `spark plug`. *speciality* becomes `specialty`.

*Tyre* is a `tire`.

The *underground*, aka *tube*, is called the *subway*. Then the question is, what is the subway in the US called? `Utilize` is *utilise*.

*Windscreen* is a `windshield`. The *wing* of the car is `fender`. The *wing mirror* is the `side-view mirror`.

As an addition to, and the generalisation of the above, we have the following. Regarding suffixes, the *~ence* becomes `~ense`, for example *defence* – `defense` and *offence* – `offense`. The *~ise* is always `~ize` and vice versa but not necessarily so.

# False Friend

Kit Tyabandha, Ph.D.

## A, a

**aboard v** on or into a ship, aircraft, *etc*.

**abroad**, in or to a foreign country; being circulated widely.

**advice** *n* suggestion.

**advise**, **v** to suggest.

**ambassador** *n* an officer representative of his country in a foreign land, a diplomat. He lives in an

**embassy**, .

**ambulance** *n* vehicle for carrying sick people to hospitals.

**ambulatory**, *adj* capable of walking.

**angel** *n* heavenly being.

**angle**, *n* corner.

**annals** *n* story of events yer by year; historical records.

**anal**, *n* of the anus.

**avenge v** take vengeance on someone for the wrong done to one's self.

**revenge**, **v** take vengeance for someone else or for the wrong he received.

**awake** *awake – awoke – awake (awoke)*

## B, b

**behalf** *n* representation.

**behave**, **v** conduct.

**benzene** *n* colourless liquid obtained from petroleum and coal tar, used for making plastics.

**benzine**, *n* colourless liquid mixture of hydrocarbons from petroleum, used in dry-cleaning.

**brake** *n* device for reducing the speed; **v** slow down using a brake.

**break**, **v** destroy into pieces; *n* interval.

## C, c

**capital** *n* controlling city.

**the Capitol**, *n* building where the US Congress meets in Washington.

**clash v** strike together.

**crash**, **v** fall or strike *sth*.

**cloth** *n* material or fabric woven from cotton, wool, silk, *etc*.

**clothe**, *vt* put clothes on *sb*.

**cloths**, *n pl.* of *cloth*.

**clothes**, *n* dress, garments.

**compliment** *n* praise, approval.

**complement**, *n* contrastingly combine with *sth* to form a whole.

**confuse v** bewilder; mix up.

**confute**, **v** disprove; show error through argument. thus *confusion* and *confutation*.

**Confusius**, *n* Chinese ethical teacher.

**Confucian**, *n* follower of Confusius. *adj* of follower of Confusius.

**congenial** *adj* similar in temperament; suited.

**congener**, *n* one similar to another.

**congenital**, *adj* present at birth.

**conjugate v** change the verb, for example to suit the number and tense.

**conjugation**, *n*.

**decline**, **v** change the adjective, noun, or pronoun according to the cases.

**declension**, *n*.

**conscious** *adj* being aware.

**conscience**, *n* awareness of what is right and what is wrong.

**conscientious**, *adj* done with great attention and care.

**contend v** struggle; argue.

**content**, **v** satisfy.

**cuckold** *n* one whose wife commits adultery.

**cuckoo**, *n* migratory bird called after its cry.

## D, d

**dairy** *n* place where milk products are made.

**diary**, *n* book for recording things in each day.

**deduce v** arrive at *sth* by reasoning; infer *sth*.

**deduct**, **v** take away.

**depart** *n* leave.

**deport**, *n* legally force *sb*.

**department** *n* division; area of activity or knowledge.

**deportment**, *n* bearing; way of standing and walking.

**deportation**, *n* deporting or being deported.

**deprave v** make morally evil; corrupt.

**deprive**, **v** take away from.

**desert** *n* barren land.

**dessert**, *n* sweet dish eaten at the end of a meal.

**desk** *n* a piece of furniture with flat or sloping top and drawers, usual found at schools or in an office.

**table**, *n* similar to desk but has no drawers.

**develop** (the spelling 'devellop', however, does not exist).

**disapprove v** to show a different opinion from somebody. But,

**disprove**, is, **v** to show that he is wrong.

**disillusion** This is a verb not a noun, despite the suffix it has.

**disillusionment**, *n*.

## E, e

**equivalence** *n* being the same.

**equivalent**, *adj* same. *equivalent* or *equivalence n sth* that is the same. In other words, both are a noun when they have the same meaning, where otherwise one an adjective while the other a noun.

**etching** *n* making relief patterns on a piece of metal using needle and acid, *esp* to be used for printing afterwards.

**ethonology**, *n* science of the races of mankind and their interrelationship.

**ethic** *n* system of morality.

**ethnic**, *n* tribal; pagan.

**evermore** *adv* forever; always.

**ever more**, more and more.

**exploit** *n* brave, adventurous deed.

**exploitation**, *n* using *sb*/*sth* selfishly and unfairly.

## F, f

**fair** *adj* beautiful.

**fare**, *n* money charged for a journey.

**fiancé** *n* engaged person intending to marry.

**finance**, *n* management of money.

**flagrant** *adj* obviously wicked; scandalous.

**fragrant**, *adj* sweet-smelling.

**fluorescence** *n* the property of a substance whereby radiations are taken in and then sent out again in the form of light.

**inflorescence**, *n* the arrangement of a plant's flowers on the stem; collective flower of a plant.

**forth** *adv* onwards.

**fourth**, *pn* next after third.

## G, g

**gorilla** *n* large African ape.

**guerrilla, guerilla**, member of an armed band that makes sporadic warfare.

**gull** *n* kinds of long-winged seabird.

**gullet**, *n* throat and food passage between mouth and stomach.

## H, h

**holistic** *adj* treating the whole of something or someone, not only a part.

**holy**, *adj* godly.

**hollow** *adj* having a hole inside.

**holly**, *n* evergreen shrub with glossy, prickled leaves and, in winter, red berries.

**holy**, *adj* of God.

**humility** *n* humble attitude of mind; modesty.

**humiliation**, *n* making *sb* feel ashamed or disgraced; lower the self respect or dignity of.

## I, i

**imprudence** *n* not being prudent, unwise, indiscreet.

**impudence**, *n* rudeness

**incidence** *n* extent of some happening.

**incident**, *n* a happening.

**it's** (contraction of) it is.

**its**, belonging to it.

## J, j

**judicial** *adj* of the law.

**judicious**, *adj* prudent.

## K, k

**kine** *n* cows.

**kinetics**, *n* theory of science relating motion of bodies with forces acting on them.

## L, l

**lead** *n* a chemical element.

**led**, (*past.* of *lead*) guided.

**lighting** *n* illumination.

**lightning**, *n* flashes of light, accompanied by thunder, whose cause is the electrical current passed between clouds or between clouds and the ground.

**lose v** have something taken away.

**loose**, *adj* detached from its place.

## M, m

**manger** *n* a trough in a stable for feeding cattle or horses.

**mangle**, *n* a machine with cylindrical parts which are turned to squeeze wet clothes.

**meet v** come together.

**meat**, *n* animal flesh.

**mercy** *n* kindness.

**mercenary**, *adj* only in the interest of making money.

**minister** *n* head of government department; clergyman.

**ministry**, *n* government department; duty or service of a clergyman.

**the ministry**, *n* the ministers of a religion.

**mistaken** *adj* and *pres. part.* of *mistake*. It is not a verb.

**monograph** *n* detailed scholarly study of a subject.

**monologue**, *n* talking alone; soliloquy.

## N, n

**notable** *adj* worthy of note.

**notorious**, *adj* ill-famed.

## O, o

**ounce** *n* lynx. *n* $\frac{1}{16}$ lb. avoidupois.

## P, p

**particular** *adj* specific.

**particulate**, *adj* as separate particles.

**peace** *n* absence of war.

**piece**, *n* a part.

**peculation** *n* embezzling.

**peculiar**, *adj* strange.

**speculation**, *n* buying and selling things with risk of loss and hope for profit through changes in their market value.

**pence** is the plural of

**penny**, , so it has no further plural form. Neither does *penny* have other forms for its plural.

**pendulum** *n* swing weight hung by a rod.
**pudendum**, *n* external sexual organ.
**plain** *n* flat land.
**plane**, *n* flat surface.
**policy** *n* plan of action.
**polity**, *n* form of government.
**politics** *n* science and art of government.
**political**, *adj* and
**politically**, *adv*. but
**policy**, *n* plan; practical wisdom. has
**politic**, *adj* well-judged, prudent. and
**politicly**, *adv*.
**presume v** take for granted.
**assume**, **v** take as true before there is a proof. As 'Assume everything; presume nothing'.
**principal** *n* main.
**principle**, *n* basic, underlying truth.
**propose v** formally suggest a marriage.
**proposal**, *n* suggestion of a marriage. but
**proposition**, *n* expressed opinion.
**proposition**, **v** offensively suggest sexual intercourse.

## Q, q

**quit v** give up.
**quits**, *adj* being on even terms.

## R, r

**remembrance** *n* remembering.
**resemblance**, *n* likeness.
**rest v** keep still; not moving.
**restive**, *adj* restless; resisting control.
**road** *n* broad track; route; way.
**street**, *n* metalled road with houses on both sides.

## S, s

**sail** *n* canvas sheet to catch the wind and drive a ship.
**sale**, *n* selling.
**seam** *n* line where two edges meet or are joined together.
**seem**, **v** appear.
**series** *n* (both *sing* and *pl.*) thing in succession; sequence; set; row. *math* items divided from each other by additions.

**sequence**, items divided by commas.

**shear v** cut the wool off a sheep by using shears.

**sheer**, *adj* absolute, complete; perpendicular, without a slope.

**shed v** fall; take off.

**shred**, **v** tear into pieces.

**shared**, *past. part.* having in common.

**show v** *past.* showed, *past. part.* shown or showed.

**shew**, is *pres*.

**spout** *n* projecting tube on a vessel for pouring its contents out; projecting pipe conveying water from a roof.

**spouse**, *n* husband; wife.

**sprout**, *n* develop shoots, buds, *etc*.

**starting** *n* beginning.

**startling**, *n* causing a surprise.

**starling**, *n* a kind of common European bird.

**steps** *n* places for feet when going from one level to another.

**stairs**, *n* steps, *usu* inside a building, leading from one floor to another.

**subway** *n* underground passage to cross under the street from one side to the other . In the US it means not this but the underground train.

## T, t

**testimonial** *n* document declaring abilities.

**testimony**, *n* statement made under oath.

**testimony** *cf testimonial*.

**than** *conj* (used to express inequality).

**then**, *adv* at that time.

**their** belonging to them.

**there**, *adv* in, at, or to that place.

**they're**, (contraction of) they are; they were.

**to** *prp* in the direction of.

**too**, *adv* also.

## U, u

**unman v** weaken the courage.

**unmanly**, *adj* not manly.

**unmanned**, *adj* not manned, without a crew.

## V, v

**vend v** to sell.

**vent**, **v** give an outlet for. *eg* You vent, not vend, your anger on somebody.

## W, w

**waist** *n* part of body circumscribing the body at the level of the navel.

**waste**, *n* refuse.

**we're** (contraction of) we are; we were.

**were**, (*past.* of *are*).

**who's** (contraction of) who is; who was; who has.

**whose**, of whom.

## Y, y

**you're**

**your**,

# Plato

Kit Tyabandha, Ph.D.

## Introduction

I had been reading Plato's works for quite a while, in particular in the John Rylands University Library in Manchester during June and July 2006 when I read Crito until 27 June, Phaedo 28 June, Cratylus 1 July, Theaetetus 4 July, Sophist 6 July, Politikos and Parmenides 14 July, Philebus 17 July and Symposium 20 July. After that I had to go away from Manchester, and so the reading was discontinued.

I wrote in my note on 14 July 2006, 'my $\infty \equiv 1 \equiv 0$ a rediscovery!' Then, 'my God a Superset a rediscovery!' I had discovered these on my own through my search and research. But my research must have been influenced much by Plato's works, so unknowingly I had arrived at my ideas through his influence.

Thinking that my understanding was something new and worth telling people about I was serious enough to write and submitted papers to philosophical journals, namely *God the Superset* to Journal of Theological Studies on 2 November 2005, then to Philosophy Journal on 8 December 2005. And then, seeing nobody accepted articles on my pet little discovery, I submitted it again to The Nation newspaper in Bangkok. Still until now no one has shown an interest to publish my works on the subject.

The realisation through reading Plato that everything was a rediscovery came as a relieve. I then realised that my articles would not have been necessary, and definitely was no longer needed. Therefore I left everything behind and began a series of pilgrimages. Of course there were other reasons for my leaving Manchester, but looking back now this seems to have been a probable cause.

From 2$^{nd}$ to 9$^{th}$ August 2006 I went around by coach on a British Explorer ticket. Then I went to the Outer Hebrides, namely at Caloway and Garenin. I was back from the island on 11$^{th}$ August and stayed at Rhenigidale. I got a lift to Gairloch where I stayed on 12$^{th}$ August, and on 13$^{th}$ August the same lift landed me in Lake District. I explored Cumbria until 19 August 2006. Between 22$^{nd}$ August and 3$^{rd}$ September

2006 I walked the Pennine Way, then from 5th until 8th September the Hadrian's Wall. During 11–14 September I helped with some works at Scargill House. From 17th until 26th September I walked the Offa's Dyke Path. Thereafter for one month my pilgrimage led me to Oxford, Cambridge, London and the area around them, and to the Stonehenge.

Kit Tyabandha
The UK and Siam

| *SPT Greek* | *Encyclopaedia Britannica* | *English* |
|---|---|---|
| *Euthyphrwn* | *Euthyphrō̩n* | Euthyphro |
| *Apologia Swkratous* | *Apologia Sō̩kratous* | Apology |
| *Kritwn* | *Critō̩n* | Crito |
| *Phaidwn* | *Phaedō̩n* | Phaedo |
| *Kratulos* | *Cratylos* | Cratylus |
| *Theaitytos* | *Theaetētos* | Theaetetus |
| *Sophistys* | *Sophistēs* | Sophist |
| *Politikos* | *Politikos* | Statesman |
| *Parmenidys* | *Parmenidēs* | |
| *Philybos* | *Philēbos* | Philebus |
| *Sumposion* | *Symposion* | Symposium |
| *Phaidros* | *Phaedros* | Phaedrus |
| | *Alkibiadēs* | Alcibiades |
| | *Hipparchos* | Hipparchus |
| | *Erastai* | Lovers |
| | *Charmidēs* | |
| | *Lachēs* | |
| | *Lysis* | |
| | *Euthydēmos* | Euthydemus |
| | *Prō̩tagoras* | |
| | *Gorgias* | |
| | *Menō̩n* | Meno |
| | *Hippias Meizō̩n* | Hippias Major |
| | *Hippias Elattō̩n* | Hippias Minor |
| | *Iō̩n* | |
| | *Menexenos* | Menexenus |
| | *Politeia* | Republic |
| | *Timaeos* | Timeaus |
| | *Critias* | |
| | *Nomoi* | Laws |
| | *Epinomis* | |

**Table 1** *list of Plato's works*

# Euthyphrwn

**Problem 1.** What is holiness, what unholiness?

§

**Problem 2.** By which things are all holy acts holy?

§

**Problem 3.** Is everything that is holy right, everything right holy?

§

Plato leads us through discussions by which a conclusion is arrived that holiness and things that all gods love are different. We also find that reverence implies fear, but not the other way round, that is fear does not necessarily imply reverence. In other words reverence is a subset of fear.

Similarly odd number implies number, but not number odd number, since odd number is a subset of number.

# Apologia

Wisdom is not saying you know when you know not.

When a leader is ousted out no matter how popular he might once be it is because the sentiment risen against him from the mass not by the doing of any particular person, though the latter may have done it. Likewise in an assassination the assassin has far less to do with the cause than with the brutal action conducted.

Socrates knew how it was not his archenemy but the people that were rising against him.

> . . ., that great hatred has arisen against me and in the minds of many persons. And this it is which will cause my condemnation, if it is to cause it, not Myletus or Anytus, but the prejudice and dislike of the many.

Injuring a man unjustly you injure yourself. Soul is more important than money. If you fight for the right and want to preserve your life for a while, then be a private citizen not a public man.

More than answers, the question is more important. Until you know what holiness is, do not prosecute anyone. On the other hand, you can never know what holiness is.

Socrates was speaking to a Roman soldier, and he said to him thus, 'You follow men's commands, why do you not follow God's regardless of fear and danger?'

'I do not do it for money,' he said, 'poverty is my witness.'

'I am convinced I have intentionally done no one wrongs, but I can not make you convinced.'

No one know death. Yet we fear death, what we do not know. Do not presume to know what you do not. Do not fear death.

He was being prosecuted, and said to his friend, 'I go to die, and you to live; but which of us goes to the better lot, is known to none but God.'

# Crito

I think Plato thinks that the state is god, and that we belong in it.

Similar to what Shakespeare said, Plato also tells us that sometimes we need to change our mind on certain things in order to find ourselves. Shakespeare put it this way in *Love's Labour's Lost* (Act 4, Scene 3),

> Let us once lose our oaths to find ourselves,
> Or else we lose ourselves to keep our oaths.

It is better to die virtuous than to live in shame.

Then, Crito, let it be, and let us act in this way, since it is in this way that God leads us.

# Phaedo

Philosophy is the study about death, and dying.

**Theorem 1.** Soul exists.

**Proof.:** Things are generated from their opposites. Therefore the living is generated from the dead. Therefore soul exists. □

Learning is recollection. But instincts exist. Hence souls exist.

Plato argued that the sense of equality and absolutes is acquired before birth. Souls, through pleasures are captured by the body and part with the communion with the divine, pure and absolute. We should behold that which is true and divine and not a matter of opinion. He asked whether we are inferior to swans who sing best when they are about to die.

Souls are like men, bodies clothes. Both wear out several of the other after a while.

One should argue after the truth, not to protect one's opinions.

Knowledge is a recollection.

Is soul a kind of harmony? Can we make an analogy lyre–harmony and body–soul? Harmony comes after a lyre, and gone before it. Is it true likewise that the soul arrives after the body and departs before it? Since souls may oppose bodies, therefore such analogy is not possible. Also, harmony may have degrees, that is there can be more or less of it whereas souls are equal. The oneness of souls implies perpetual harmony.

The trouble with literal argument is that the language, the wordings are sometimes tricky. Perhaps a way out of this is to use mathematics, with its strict definitions, and to use physics, with its quantitative style of study.

People usually worry themselves with things instead of with the

power which drives them.

There exist absolutes, things are beautiful because of beauty they contain.

All things have their opposites. Nothing admits its opposite. Soul causes life, as number one address. So the opposite of soul is death Therefore soul does not admit death, that is to say, the soul is immortal.

Questions still remain after Plato. For instance, is it a mere matter of personification, of souls shunning those souls who had done wrong? Since all souls are equal and never evil, does death free them from the world and from earthly guilts?

Water encompasses fish. The earth encompasses water. The universe encompasses the earth. Then the soul encompasses the universe. The soul live much longer than the earth, as long as the universe. Then is there a higher soul yet encompassing it? And then God encompasses everything.

I think this has an influence on C. S. Lewis's Trilogy, namely *The Cosmic Trilogy*, comprising *Out of the Silent Planet* (1938), *Perelandra* (1943) and *That Hideous Strength* (1938).

When it comes to morals and the segregation of souls Plato switches suddenly to myths, for example that about Tartarus and Achenon, even though he also said that he did not mean it literally. I find such idea of merits and rewards still pagan.

> And of these, all who have duly purified themselves by philosophy live henceforth altogether without bodies and pass to still more beautiful abodes which it is not easy to describe, nor have we now time enough.

'Is heaven the universe?', I asked myself. If so, limbo must be the diffusion time to join it.

We may not live in vacuum of space but that is where our soul belong. Therefore we fear God, but our souls rejoice in Him. The reunion of the goods and the bads means a punishment for the latter but a reward for the former.

In his story Phaedo represents all our worldly life.

If you take care of yourselves you will serve me and mine and yourselves, whatever you do, . . .

Compare this with what Buddha said (*cf Buddhapada* 166).

# Cratylus

Names are what the gods call things, for example 'gene' and so on. There is a difference between *true* names and *word* names. Definitions are true names.

The question Plato presents here is an extremely interesting one, even though some of the investigations are rather naive.

Plato talks about some words in Greek. There is a word 'daýmones', which means 'wise and knowing'. There is another word 'daímones', which means 'spirits'. The word 'ýrws' means 'hero' In its Attic form it is 'heros', and in Ionic 'HRWS'. The word 'érws' means 'love'. Its Ionic form is 'ERWS'. Definition is association, association of words. Thus it is that through the facade of etymology Plato discusses serious things.

According to Plato there are words which are considered elemental, which are the origin of all names. These words are also imitation, but of neither shape, sound, nor colour. One could present these elemental words by letters, and then combine them into other words. What we have is then a construction of a systematic language.

Plato said that 'f', 'ps' and 's' represent violent movements. Further 'd' means binding, 't' rest, 'l' gliding movement, 'n' internal, 'a' greatness, 'y' length, and 'o' round. The idea being looked at here is now a well developed information coding in coding theory. We have here, however, informing names.

Lawgivers make definitions. Pictures can be either like or unlike, in other words either correct or wrong. Similarly names can be either seeming or unseeming, that is either true or false. Since both names and laws are words, therefore some lawgivers are good and others bad.

Words are, however, but images, which are not to be exactly the same as the things they themselves represent. Plato presents the following question.

> . . . the image must not by any means reproduce all the qualities of that which it imitates, if it is to be an image?

A name must be different from the thing, or else they would be duplicates of thing not a thing and its name. Thus there are different degrees of correctness of words, and hence of clauses and sentences. Also there are primary names and composite names.

Correctness and trueness are mere convention. Custom and conventions play a role in correctness of names.

Socrates talks about *amathía* (ignorance), and contrasts it with *toû ạ́ma theôi ióntos poreía* (the progress of one who goes with God).

How is reality to be learnt and discovered? Since all things are changing, therefore it is better to learn from the actual things in terms of their absolute qualities than to learn from their names.

The following sounds uncannily like a precursor to Heisenberg's uncertainty principle in Quantum Mechanics.

Pŵs oûn àn eíy tì ekeîno ọ̀ mydépote ṿsaútws échei?

How, then, can that which is never in the same state be anything?

Ạ́ma gàr àn epióntos toû gnwsoménou állo kaì alloîon gígnoito ṿste ouk àn gnwstheíy éti ọpoíón gé tí estin ý pŵs échon; gnŵsis dè dýpou oudemía gignẃskei ọ̀ gignẃskei mydamŵs échon.

For at the moment when he who seeks to know it approaches, it becomes something else and different, so that its nature and state can no longer be known; and surely there is no knowledge which knows that which is in no state?

'Geometry or any other form of philosophy?' Geometry is mathematics is philosophy, therefore to Plato mathematics is philosophy.

Socrates is the questioning in us! It is said that he did not exist as a person as such. May be this is true, and he could represent the critical thinking in us. As a testimony to this, those leaving him earlier than they should found bad companies, and so on. He makes minds pregnant in labour and, 'the delivery is due to the god and me.'

Socrates complained, 'they have considered impostures and images of more importance than the truth.'

'You could not rightly ascribe any quality whatsoever to anything' Compare this with Jesus's 'judge not!', and Buddha's 'no diṭṭhi!'

'Nothing ever is, but is always learning.' This is search and research, as Buddha had taught in his Kalamasutra and in his saying against *diṭṭhi* (opinion). 'Ésti mèn gàr oudépot' oudén, aeì dè gígnetai.'

Looking at Plato's argument, then Swkratys (Socrates) is the questionings and critical thinking. Eukleidys, Terpsiwn, Theodwros and Theaitytos are all within him. Compare this with the Me in Christ in God. In the point of view of Plato perhaps it is the Me in Socrates in God. But since the questioning of an inquisitive mind can never exceed the boundary of knowledge, that is to say, reality and universe, whereas God could, we could combine these two statements to make the Me in Socrates in Christ in God. Here the Me is limited to within the Soul, Socrates is bounded by an initiative limit, Christ is bounded by the boundary of knowledge, namely the universe and the limit of our comprehension, and God is the Superset.

'Nothing is which appears.' Compare this with Shakespeare's 'nothing is but what is not.' We have no proof whether this is wakefulness or a dream.

There are only unions of things, no definite being or becoming.

'None of the arguments comes from me, but always from him who is talking with me.' The questions belong to humanity, the solutions to us.

Is knowledge the same as perception? Our Socrates led us on our way to answer this question. We remember even when we no longer see the things, therefore knowledge and perception are different. Furthermore, if perception and knowledge are the same, then we are led to all sorts of contradiction, for example if we shut one eye then we must be at the same time both knowing and not knowing. But our memory of having felt something is not the same as the time when we felt it. Therefore it is possible to both know and not know at the same time.

The Socrates in us should be impersonal. The solutions we arrive at are our brainchild.

'But he is dead, and we are abusing the orphan.' The father is

dead, leaving an orphan defenceless. The guardians refuse to help. We refuters must do so in the name of justice. (Compare this to Shakespeare's *Sonnets*)

What is the difference between a philosopher and a lawyer? A philosopher is free and at leisure whereas a lawyer is in a hurry.

God is in no wise and in no manner unrighteous, but utterly and perfectly righteous.

'Two patterns, my friend, are set up in the world, the divine which is most blessed, and the godless, which is most wretched.'

Trueness may not vary from person to person, else if A says, 'I am true and you are true' while B says, 'I am true but you are false', then A would be false.

The ancient says, 'the origin of all things is Ocenus and Tethys, flowing streams, and that nothing is at rest'. Melissus and Parmenides says, 'everything is one and stationary within itself.' '*Sthîon akinyton teléthein wi pánt' ónom' eînai*', 'so that it is motionless, the name of which is the All.'

The above argument shows juxtaposition between 'the whole' and 'flowing'. Both seem to be correct, that is flowing within the whole. In other words, the concept of the whole is correct so long as we keep in mind that it is not static but dynamic.

There are two kinds of motion, that is alteration and motion in space. Perception and the percipient are active, whereas the perceived and quality are passive. Is movement when the passive becomes percipient, but not perceptive, and the active becomes, not a quality, but endowed with a quality?

Are all things in flux? If so and if perception is knowledge, then knowledge is not-knowledge.

What is opinion, what is false opinion? '*Autò deíxei*', 'the event itself will show.' Opinion comes with persuasion, whereas knowledge comes with teaching. True opinions are no knowledge. Take judges as an example, they may be persuaded without being taught.

Knowledge is true opinion together with reason. Primal elements

are perception, so they are truth but no knowledge. Compound things could be either true opinion or knowledge, so they are both truth and knowledge.

The whole is different from all, for we know names but not the letters.

This is the question of existence, the same question of 'to be or not to be.' We may know what a code stands for, but do we really understand each letter of the alphabet used to make up the words of the code? We know things, but not the Creator. In other words, we knot God, but not all things He creates.

Is 'all' in the singular the same as 'all' in the plural? '*Tà dé ge pánta méry tò pân eînai ṿmológytai, eíper kaì ọ pâs arithmòs tò pân éstai*', 'but we are agreed that the all must be all the parts if all the number is to be the all.' '*Tò ólon ár' ouk éstin ek merôn, pân gàr àn eíy tà pánta òn méry*', 'then the whole does not consist of parts for if it consisted of all the parts it would be the all.'

'Knowledge is the ability to tell some characteristic by which the object in question differs from all others.'

# Sophist

A part of Art is acquisitive. A part of acquisitive art is coercive. A part of coercive art is called hunting.

Things can be for the body or for the soul. Examples of those for the soul are arts.

Plato looks at the definitions of Sophists, statesmen and philosophers.

All badness comes from stupidity (thinking one knows when one does not). Thus the remedy is education, and the heart of education cross-questioning.

'Not-being' is absurd and should exist in neither singular or plural.

> That not-being reduces him who would refute it to such difficulties that when he attempts to refute it he is forced to contradict himself.

'*That* which *is* not'! 'Defeated in the refutation of not-being.'

Yet Plato's *not-being* is but an abstraction of the physical idea of number. One could say it is a grammatical number. As mathematics it belongs to a language, not the physical world. So long as Euclid's *point* with no dimensions, *line* with one and only one dimension, and *plane* with exactly two dimensions exist, so could our *not-being*.

Thus Sophists, who are image-makers, are difficult to refute.

Who say that images are not-being? Images are created beings, that is things.

*Not-being* is an idea similar but more profound than, for instance, *no one*. In the case of the latter one could imagine *someone* is there, and then take that someone out. The space remaining there is therefore that *no one*. In other words it is a complementary self. Similar *nothing* is no *not-being* but a *not-a-thing*.

# Parmenides

> *Stranger*: In defending myself I shall have to test the theory of my father Parmenides, and contend forcibly that after a fashion not-being is and on the other hand in a sense being is not.

'Ou gàr mý pote toûto damŷi, physín, eînai mý eónta; allà sù tŷsd' aph' ọdoû dizýmenos eîrge nóyma', 'never let this thought prevail, saith he, that not-being is; but keep your mind from this way of investigation.'

Could *not-being* be on the same par with false words, false opinion, image, likeness, imitation and appearance? Trying to disprove one's own theory, say the both being and not-being are. But the both are being, and no not-being at all.

In addition to what Plato said, could not-being be considered as being neither thing nor space, nor no-space, nor no-non-space? But then again the word 'being' we used preceding the 'neither' has betrayed us somewhat. Shakespeare would have said, 'and nothing is but what is not.' What is a thing but atoms plus space. What is an atom but nucleids plus space. What is nucleids but quarks plus space, and so on.

Are we merely names of the same thing? (that is being?) The names are merely names of names.

'Xenos Eleatys: *Kaì tò ẹ́n ge, ẹnòs ó, noma òn kaì toû onómatos aû tò ẹ́n ón*', '*An Elean Stranger*: And the one will turn out to be the name of one and also the one of the name.' *One* is both the name of unity and also the unity of which the word 'one' is the name.

One implies parts, yet one must be absolutely without parts. Being identified by unity, the all will be more than one, else if absolute whole exists, the being lacks something of being. Then the being is not-being, since it is deprived of being. If the whole does not exist at all, the being could not have ever come into existence.

Adding to what Plato has said, nothing less than the All is anything. If we look at an aggregate of particles, ultimately no boundaries are definable. God is a distributed system and we are also distributed systems. Is the body fluid in us us, fluids in our cells us? What all

things are are but parts of All, with no meaningful boundaries definable.

Nothing apart from the whole can have quantity.

Plato discussed movement as against rest. In nowadays context we have Big Bang versus a stationary universe.

Discussing Sophist versus philosopher, Sophist is like darkness for they hardly see, whereas philosopher the brilliant light of the divine, 'for the eyes of the soul of the multitude are not strong enough to endure the sight of the divine.' Sophists look at not-being whereas philosophers at being. Furthermore, Sophists use practical and empirical methods whereas philosophers use ideas in their study.

> In relation to each of the classes, being is many, and not-being is infinite in number.

The prefix 'not-' indicates something different, not opposite.

> The attempt to separate everything from everything else is not only not in good taste but also shows that a man is utterly uncultivated and unphilosophical.

God is the Superset.

> The complete separation of each thing from all is the utterly final obliteration of all discourse. For our power of discourse is derived from the interweaving of the classes or ideas with one another.

The negative has only a relative existence and is not the opposite of the positive, but only differ from it. Not-being is one of the classes of being, permeating all being.

'*Phaínetai gàr oûn problymátwn gémein*', 'for he seems to have no end of defences.'

Let us look at the interrelationship between speech, opinion and image-making. Speech could be affirmative or negative, opinion trueness or falsehood, and image-making likeness or fantastic. A Sophist is the imitator of a philosopher. Long speeches mark a statesman.

# Politikos

Classes are parts. A statesman is a herder of harmless animal. Plato compares man with pig.

The Creator created and then left the universe alone. Entropy increases, and then the Pilot takes over.

But who is the Pilot but the Creator himself.

The universe runs forwards until it reaches an ultimate point from where it then reverses the direction. Then everything runs backwards, for example birth from the earth, and so on, until an absolute annihilation.

The art of weaving should include that of making weaving tools. The division becomes a mess if not impossible. Thus we could divide arts into contingent part, which provides tools, and actual part, which makes the thing.

The standard of the mean exists if and only if the art concerned exists. Greater and less are relative to one another and to the standard of the mean.

> And, moreover, anyone who finds fault with the length of discourses in our discussions, or objects to roundabout methods, must not merely find fault with the speeches for their length and then pass them quickly and hastily by, but he must also show that there is ground for the belief that if they had been briefer they would have made their hearers better dialecticians and quicker to discover through reason the truth of realities.

The above passage may remind one of the case of the proof of the four-colour theorem.

Is everything that exists the instrument of something or another? Then in addition to Plato's discourse, is everything that exists the instrument of everything? The latter is added because it explains the idea of shared responsibility. All guilts committed by a person are shared by humanity as a whole.

Do all forms of government try to imitate a rule by a single ruler? Monarchy can be royalty or tyranny. It is the extreme case which could be best or worst. The rule of the few can be aristocracy or oligarchy. This is a moderate form of government. The rule of the many, that is democracy, can be lawful or lawless, as in mob rule. This is a weak form of government. It is worst in orderly time, best in chaotic one.

Both self-restraint and courage are subsets of virtue. At times they intersect each other. The weaving together of restraint and courage makes a statesman.

# Parmenidys

'For you in your poems, say that the all is one?' Is existence one or many?

> . . . and when it was written some one stole it, so that I could not even consider whether it should be published or not.

All things are one and many, but the one is not the many nor the many the one, that is to say, absolute one and many. In addition to Plato, infinity and one and zero are equivalent (absolute one and zero), and that is God. In other words, infinite field and trivial fields are the same.

An idea is one and the same, but is in many places at once, that is to say, it is in all its participants at the same time. This is like spreading a sail over many persons and say it was one, and all of it was over many. Only a part of an umbrella covers each thing. Thus a part is not the whole.

The one cannot be the many. Therefore it can have not parts. It also can have no beginning or end. That is to say, it is unlimited.

Is each idea one and distinct from concrete things? Ideas are thought, thought of something. That something is again an idea. Then is everything an idea?

> *Kephalos*: Antiphon said that Pythodorus told him that when Zeno said this he himself and Antiothenes and the rest begged Parmenides to show his meaning by an example and not to refuse.

The one is unlimited and *not at all*. It cannot be in anything, not even in itself. It cannot surround anything. It cannot move in space. Neither can it move in time. It can be in any time.

Adding to Plato, One is no singular, no plural, nothing. If we accept that God is Superset, then all these issues are solved, and so could we prove the One.

Next we look at being and unity. All parts are composed of these

two. Then the One, that is the Whole, comprises both being and unity. Hence the One must be infinite.

Additionally the One is the infinite of infinities. Being is a subset of other, that is the complement of one. So being differs from one by virtue of that other.

Now what about one and being one?

It seems there can be both without twoness, that is interspersed, undefinable boundary. Compare this with the Holy Spirit.

If one exists, then number exists. To see this we look at one and other, which make up a pair, that is to say, two. Next we could look at one, other and pair, and have then three. This leads us to all numbers.

If number exists, they must be infinite.

Thus Plato succeeded in reasoning how the existence of one implies the existence of infinite!

> Existence, then, is distributed over all things, which are many, and is not wanting in any existing thing from the greatest to the smallest?

Yes, 'for how can existence be wanting in any existing thing?'

> It is split up into the smallest and greatest and all kinds of existence; nothing else is so much divided, and in short the parts of existence are infinite.

'Its parts are the most numerous of all.'

> Then unity is an attribute of every part of existence and is not wanting to a smaller or larger or any other part.

Plato looks at one and existence. One is as many as its parts, which is infinite, that is as many parts as existence's.

All the parts are in the whole, the whole not in any part.

> For if it is in all, it must be in one, for if it were wanting in any one it could no longer be in all; for if this one is one of all, and the whole is not in this one, how can it still be in all?

This is a solution to the Old Testament before Jesus gave us his. Also, one wonders whether the Greeks worked much with real numbers. Since they knew Pi and worked with geometry and Pythagoras, they must have known real numbers. But Plato's arguments seem to be based solely on integers. Perhaps his purpose is to make it simpler, and clearer to clarify things. Modern analysis seems to be influenced much by Plato's method.

The one was, is and will be.

In other words, Superset covers all time.

> Then the part is a part, not of the many nor of all, but of a single form and a single concept which, we call a whole, a perfect unity created out of all.

The one is different from the other, and vice versa. They are in the same state, that is like each other. We have now one, other, whole and all.

> Therefore if one exists the one is all things and nothing at all in relation both to itself and to all others.

If one does not exist, then non-existent needs existence to continue being non-existent. The one needs existence to attain non-existence. That is the one has existence.

One can see therefore that the one both is and is not. Compare this with Shakespeare's 'to be or not to be.'

The non-existent one partakes no such attributes as greatness or smallness, likeness or difference, and so on.

This seems like trying to find whether God is the one or the non-existent one (not whether God exists or not, because the non-existent exists!) The non-existent one is different, but not to the one since that does not exist, then to each other lest it be others of nothing. They are fractions mutually different (not each one's, since one does not exist.) They appear one from a distance, at closer inspection infinite in number.

Is this the origin of epsilon and calculus?

'If the one is not, nothing is.'

> Whether the one is or is not, the one and the others in relation to themselves and to each other all in every way are and are not and appear and do not appear.

'If the others exist and the one does not, the others will be neither one nor many (for then, if none of them is one they are nothing at all.)'

My discovery that $\infty \equiv 1 \equiv 0$ was a rediscovery. And so was my pet definition of God as being the Superset. It can be disheartening when you read.

# Philebus

Knowledge is good, but there are many forms of it, some of which oppose others.

Man is one, ox is one, the beauty is one, the good is one.

*Prŵton mèn eí tinas deî toiaútas eînai monádas ụpolambánein alythŵs oúsas; eîta pŵs aû taútas, mían ẹkástyn oûsan aeì týn autýn kaì mýte génesin mýte ólethron prosdechoményn, ọmws eînai bebaiótata mían taútyn; metà dè toût' en toîs gignoménois aû kaì apeírois eíte diespasményn kaì pollà gegonuîan thetéon, eíth' ọlyn autýn aụtŷs chwrís, ọ dý pántwn adunatŵtaton phaínoit' án, tautòn, kaì ẹ̀n ạ́ma en ẹní te kaì polloîs gígnesthai.*

The first question is whether we should believe that such unities really exist; the second, how these unities, each of which is one, always the same, and admitting neither generation or destruction, can nevertheless be permanently this one unity; and the third, how in the infinite number of things which come into being this unity, whether we are to assume that it is dispersed and has become many, or that it is entirely separated from itself – which would seem to be the most impossible notion of all – being the same and one, is to be at the same time in one and in many.

And we must not apply the idea of infinite to plurality until we have a view of its whole number between infinity and one; then, and not before, we may let each unit of everything pass on unhindered into infinity;

'Tà dè mésa autoùs ekpheúgei, oîs diakechŵristai tó te dialecticŵs pállin caì tò episticŵs ymâs poieîsthai pròs allýlous toùs lógous', 'they disregard all that lies between the dialectic and the disputatious methods of discussion.'

Sound is one, and yet infinite in number, as in music and language. The origin of grammar was due to Theuth, perhaps an Egyptian, who divided sound in language into three group, namely vowel, semi-vowel and mutes. Then he divided each of these into primary units.

God creates the infinite, the finite, mixture of these, and the cause for this mixture.

Enjoyment or pleasure needs memory (past), opinion (present) and calculation (future). Desires are from the soul, the memory of fullness while the body is empty. Soul writes and paints into memory. There are true and false opinions. There are true and false pleasure. (Compare this with Buddha's 'no *diṭṭhi*')

Laughing is a pleasure. Envy is a pain. But laughing at a friend's mistake shows envy, thus it is both pleasure and pain, that is an unpure pleasure.

To have knowledge is a pleasure. To lost the memory of knowledge is no pain. Therefore having knowledge is a pleasure without pain, that is pure pleasure.

Things can be either generation or good. Pleasure, for instance is no good, therefore it is a generation.

Arts can be either exact or approximate. Building, for example, is exact whereas music is approximate, that is you use your guess and experience. Arithmetic is a most exact art. It has two types, that of the people and that of philosopher.

Are there two kinds of knowledge, that is to say, pure and impure? If we contemplate on this question, knowledge of those things which are transitory is less pure, that is impure. On the other hand knowledge of things which neither come into being nor pass away is considered pure.

Plato discusses mind, pleasure and truth, and put things into five groups, namely first, measure, moderation and fitness, second, proportion, beauty, perfection and sufficiency, third, mind and wisdom, fourth, science, arts, true opinions (that is those of the soul), and fifth, pure pleasure.

# Sumposion

Ca lŵs g', éphy, poiŵn sú; allà poû éstin oûtos?

'Very good of you to come,' he said, 'but where is the man?' (It's good of you to come, Agathon, but where is Socrates? ∼ Aristodemus)

'My own is but meagre, as disputable as a dream.' Socrates is the systematic questioning.

They were at a party last night. Our Socrates stays not with us when we revel.

Love is of the most venerable standing. The power of love, 'only such as are in love will consent to die for others.' One could die for love, or sleep on doorsteps.

Two kinds of love are heavenly love and popular love. For trial of lovers, a quick capitulation is a disgrace. Also lovers are disgraced if surrender from poll, public preferment, or cowering from the endurance of ill-treatment. Compare this discussion of Plato with Shakespeare's *Sonnets*, which are about the love of writers. For the love of teachers Plato gives the following.

> And he will be deemed a good practitioner who is expert in producing Love, where it ought to flourish but, exists not, and in removing it from where it should not be.

'The one at variance with itself is drawn together, like harmony of bow or lyre.' ∼ Hera Cleitus

> The universe is held together by the strain of opposite forces.
>
> All means of communion between gods and men, are only concerned with either the preservation or the cure of Love.

Love conceived as a single whole exerts a complete power both here on earth and in heaven above. Love for money, even when it turned out there was no money from our love, is no less disgrace. Love for spiritual improvement of the beloved, even when it is betrayed, is no less honourable.

Poetry is the art of composing, which in turn is anything passing from not being into being. All craftsmen are poets.

Love is all that desire of good things and of being happy. Every man should honour Love.

'One learnt leech is worth the multitude.' ~ Homer ~

A man sensible and resolute, 'he was far more proof against money on every side than Ajax against a spear.'

Socrates always shows bravery in battles, uses one word for the same thing, and gives only sensible speeches.

A fully skilled tragedian could be a comedian as well.

# Phaedrus

Passion obscures judgement. Lover thinks grievous things that cause no pain to others, and praises what ought not to give pleasure.

'The good things are not the same as the pleasant, nor the bad as the painful.'

The discourse was not only wonderful but miraculous. That was forcing Socrates to make a discourse by threatening to read no more.

Here Plato starts from a definition of love and refer to it constantly throughout.

> He ought never to have accepted a lover who was necessarily without reason, but rather a reasonable non-lover; for otherwise he would have to surrender himself to one who was faithless, irritable, jealous, and disagreeable, harmful to his property, harmful to his physical condition, and most harmful by far to the cultivation of his soul, than which there neither is nor ever will be anything of higher importance in truth either in heaven or on earth.

'The fondness of the lover is not a matter of good will, but of appetite which he wishes to satisfy.'

'Ὡs lúkoi árn agapŵs', ὥs paîda philoûsin erastaí', 'just as the wolf loves the lamb, so the lover adores his beloved.'

> But their foolishness was really funny besides, for while they were saying nothing sound or true, they put on airs as though they amounted to something, if they could cheat some mere manikins and gain honour among them.

Is Socrates a set of people, or a set of questions by various people you talk with?

> Madness, which comes from god, is superior to sanity, which is of human origin.

When 'distress and the greatest troubles' visit us 'through some

ancient guilt', madness, taking refuge in prayers, 'he who has this madness is made safe for the present and the after time.'

'A third kind of madness comes from the Muses.' This 'arouses the soul to songs and poetry, by adorning countless deeds of the ancients educates later generations.'

> *Ós d' àn áneu manías Mousôn epì poiyticàs thúras aphícytai, peistheìs ws ára ec téchnys icanòs poiytýs esómenos, atelýs autós te caì y poíysis upò tôs tôn mainoménwn y toû swphronoûntos yphanísthy.*

'But he who without the divine madness comes to the doors of the Muses, confident that he will be a good poet by art meets with no success, and the poetry of the sane man vanishes into nothingness before that of the inspired madness.'

> And our proof will not be believed by the merely clever, but will be accepted by the truly wise.

The soul is ungenerated and immortal. The proof of this is given as follows. Soul is ever moving, not moved but itself moving. Therefore it is at the beginning of generation, thereby not generated.

Perhaps soul is the God in us, and perhaps soul, Holy Spirit and God are synonyms.

'But the divine is beauty, wisdom, goodness, and all such qualities.'

> For I must dare to speak the truth, especially as truth is my theme. For the colourless, the formless, and intangible truly existing essence with which all true knowledge is concerned holds this region and is visible only to the mind, the pilot of the soul.

Soul is with God, and somehow is detached from Him.

I think soul is never detached from God, since God is the Superset.

'And when they have come away they feed upon opinion', lose their wings and fall to the ground, enter human the order of whom is,

1. a philosopher or a lover of beauty
2. a lawful king or a warlike ruler
3. a politician, a man of business, or a financier
4. a hard-working gymnast or those who cure the body

5. a prophet or those who conduct mystic rite
6. a poet or some other imitative artist
7. a craftsman or a husbandman
8. a Sophist or a demagogue
9. a tyrant

> Souls may pass from man to beast and from beast to man.
>
> For the soul which has never seen the truth can never pass into human form. For a human being must understand a general conception formed by collecting into a unity by means of reason the many perceptions of the senses; and this is a recollection of those things which our soul, once beheld, when it journeyed with God.

'The mind of the philosopher only has wings, for he is always, so far as he is able, in communion through memory with those things the communion with which causes God to be divine.' He is initiated into perfect mysteries and alone becomes truly perfect, 'separate himself from human interests and turns his attention toward the divine, he is rebuked by the vulgar, who consider him mad and do not know that he is inspired.'

This fourth kind of madness, 'when he sees the beauty on earth, remembering the true beauty, feels his wings growing and longs to stretch them for an upward flight, but cannot do so, and, like a bird, gazes upward and neglects the things below.'

> He who loves the beautiful, partaking in this madness, is called a lover.

Pure light, 'not entombed in this which we carry about with us and call the body, in which we are imprisoned like an oyster in its shell.'

# Fred Hoyle

Kit Tyabandha and Kit Tiyapan

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## The Origin of Elements

The second author, Tiyapan, had come across writings by Fred Hoyle first in 2001. Since then, through his works we have been fascinated with his genius, imagination and originality. Hoyle is an excellent teacher who was truly here to influence.

The revolutionary paper by Burbridge *et al* (1957) was in fact originated by ideas of its last author, F Hoyle. In it the authors explained for the first time the origin of all the chemical elements known. Some originate in the cores of stars, others in those of supernovae. Hoyle went on to refine this theory in his later publications, for instance the one (Hoyle, 1960) where he concludes that the $e$-process formation of the iron-group elements takes place in Type II supernovae, while the $r$-process formation of the neutron-rich isotopes of the heavy elements occurs at the core of Type I supernovae. He also coined here the abbreviation 'B$^2$FH' used to represent the 1957 paper mentioned. Since both of these papers are technical, to understand them one needs to know existing theories of stellar evolution first. One needs also to have a sound mathematical background, since Mathematics is the language of Physics, and Physics is literature.

Fowler and Hoyle (1964) explains the neutrino emission. They are friends, though people say Fowler got the Nobel Prize Hoyle deserves. In this work they listed ten possible processes that emit neutrinos. These are those occurring,

1. in hydrogen burning through proton-proton chain or the CNO bicycle,
$$4p \to \alpha + 2e^+ + 2\nu,$$

2. in beta-decays, that is to say, the production of beta-unstable nuclei during energy generation and nucleosynthesis in nuclear processes involving intermediate and heavy nuclei,

   $(a)(z+1, A) \to (Z, A) + e^+ + \nu,$

a proton in nucleus transforms into a neutron, or

$(b)(Z-1,A) \rightarrow (Z,A) + e^- + \bar{\nu},$

a neutron in nucleus, or a free neutron transforms into a protron.

Instead of (a) we may alternatively have the electron capture,

$(c)e^- + (Z+1,A) \rightarrow (Z,A) + \nu.$

Free $n$,since it has a greater rest mass, decays into $p$ through the following process,

$(d)n \rightarrow p + e^- + \bar{\nu}.$

3. In the Urca process by Gamow and Schönberg, extended by Pinaev, under equilibrium conditions at high $T$ and $\rho$ in stars. The gave the references by Gamow and Schönberg (1941), Gandel'man and Pinaev (1960) and Pinaev (1964).

   The process is this,

   (a)
   $$e^- + (Z,A) \rightarrow (Z-1,A) + \nu,$$
   followed by
   $$(Z-1,A) \rightarrow (Z,A) + e^- + \bar{\nu},$$
   or as extended by Pinaev,
   $$e^+ + (Z-1,A) \rightarrow (Z,A) + \bar{\nu},$$
   such that
   $$e^- + (Z,A) \rightarrow (Z,A) + e^- + \nu + \bar{\nu}$$
   or according to Pinaev,
   $$e^+ + e^- + (Z,A) \rightarrow (Z,A) + \nu + \bar{\nu}.$$

   The corresponding Urca process for positrons in antistars,

   (b)
   $$e^+ + (\bar{Z},A) \rightarrow (\bar{Z}+1,A) + \bar{\nu},$$

and

$$(\bar{Z}+1, A) \rightarrow (\bar{Z}, A) + e^{+} + \nu,$$

or from Pinaev,

$$e^{-} + (\bar{Z}+1, A) \rightarrow (\bar{Z}, A) + \nu,$$

therefore

$$e^{+} + (\bar{Z}, A) \rightarrow (\bar{Z}, A) + e^{+} + \nu + \bar{\nu},$$

or according to Pinaev's extension,

$$e^{+} + e^{-} + (\bar{Z}, A) \rightarrow (\bar{Z}, A) + \nu + \bar{\nu}.$$

4. As the neutrino bremsstrahlung, introduced by Pontecorvo (1959), in which a neutrino pair replaces the usual photon emitted in inelastic electron scattering

$$e^{\pm} + (Z, A) \rightarrow e^{\pm} + (Z, A) + \nu + \bar{\nu}.$$

5. As photoneutrino process, from the works by Ritus (1961) and Chiu and Stabler (1961), where a neutrino pair replaces the scattered photon in photon-electron interaction

$$\gamma + e^{\pm} \rightarrow e^{\pm} + \nu + \bar{\nu}.$$

6. In the pair-annihilation neutrino process, according to Chiu and Morrison (1960) and also Levine, in which a neutrino pair replaces the photons usually emitted in an $e^{-}$-$e^{+}$ annihilation,

$$e^{+} + e^{-} \rightarrow \nu + \bar{\nu}.$$

   These $e^{-}$ and $e^{+}$ are produced at high $T$ in stars by electromagnetic radiation field.

7. As, also according to Chiu and Morrison (*ibid.*),

   ( a) $\gamma + \gamma \rightarrow \nu + \bar{\nu}$,

   ( b) $\gamma + \gamma \rightarrow \gamma + \nu + \bar{\nu}$.

Gell-Mann (1958 and 1961) showed that (a) is forbidden for certain forms of the weak interaction. Reference is made of the work by Feynman and Gell-Mann (1958.)

8. In the Coulomb field of a nucleus, following Matinyan and Tsilosani (1961) and also Rosenberg (1963), where

$$\gamma + (Z, A) \rightarrow (Z, A) + \nu + \bar{\nu}.$$

9. In the decay of plasmons in a stellar plasma, in a work by Adams, Ruderman and Woo,

$$\gamma_{pl} \rightarrow \nu + \bar{\nu},$$

for the details of which they referred us to the review works by Wu (1961) and Reines (1960.)

10. As

$(a) \bar{\nu} + p \rightarrow n + e^{+},$

which has been detected by radiative annihilation of $e^{+}$ and radiation capture of $n$ by nuclei in experiments, and

$(b) \nu + n \rightarrow p + e^{-},$

which has yet to be observed due to the lack of high-intensity neutrino sources on earth. Fission reactors are antineutrino sources.

Not only a theoretical physicist, Hoyle also produced radio programmes and write books for a more general audience. He wrote in 1977 *Ten faces of the Universe* in which he gives an inspirational introduction to Cosmology. In this book he began by mentioning about James Jeans whose lecture in 1930 he attended at the University of Cambridge. Jeans had written the book *The Mysterious Universe* in which he argues about God the mathematician. But all attributes of God, the author said, are those of men.

Man normally gives attributes of men to God. Hoyle adopted the belief popular among scientists, that there is no god. Obviously he did not realise God is Superset. Yet he comes very close to Truth indeed when he compared repeatable results to revealed truth.

Hoyle criticised our wrong education system which 'seeks to rekindle amber after it is quenched.' A baby when 6–9 months old is highly developed in three-dimensional geometry, and when 9–15 months old in set. After that, at the same time that it begins to learn a language, the development turns downhill while the language it is learning brings with it nonsense words. He thinks that priests and clergymen cause

pain when they persist in repeating nonsense words and concepts to children. Words like 'Catholic eyes', 'Protestant legs', 'Marxist numbers', 'capitalist geometry' are similar to one another in that they are all made up of a nonsense word coupled with a valid word.

He referred to *Men of mathematics* (1937) by E T Bell, and *The mysterious universe* (1930) by J H Jeans. He also talked about a personal experience while being on a plane travelling in the north-west of Greenland, when he saw the Sun rising from the west.

Hoyle derived the theory he expounded in $B^2FH$ partly from the abundance of the elements, and the latest update then of this information seems to be that which was produced by Cameron (1970.) The abundance of elements is derived from the composition of meteorites.

The study of elements leads one to the study of fundamental particles in Physics. Atomic Physics studies electron patterns, while Nuclear Physics studies compact proton and neutron threads. The atomic number $Z$ is the number of protons, and the value of the atomic mass is relative to proton. Isotopes are different from one another in their numbers of neutrons. 'Thread and cable,' Hoyle said, 'represent a whole history.' By 'cable' he meant a group of bodies.

A neutron may turn into a proton, plus other particles, that is to say, $n \to p+$ other particles. Similarly a proton into a neutron together with some other particles, that is $p \to n+$ other particles. This leads us to the discovery of the *eightfold way*, which are in fact the eight baryons, namely $p$, $n$, $\Lambda$, $\Sigma^+$, $\Sigma^0$, $\Sigma^-$, $\Xi^-$ and $\Xi^0$. Moreover the latter six baryons here may be converted back into a neutron or a proton,

$$\Lambda, \Sigma^+, \Sigma^0, \Sigma^-, \Xi^-, \Xi^0 \to n \text{ or } p + \text{other particles.}$$

These other particles are the leptons, and the processes occur in $\mathcal{O}(10^{-10}$ s) time. Hoyle mentions the family of ten, for example $\Omega^-$.

Gell-Mann and Zweig independently discovered quark, which is categorised into up, down and strange. The strange quark is present in neither $n$ or $p$. The name 'quark' was adopted such that to avoid everyday associations. Those quarks in $p$ are up, up and down; those in $n$ up, down and down; those in $\Gamma$ up, down, strange; and those in $\Omega$ strange, strange, strange.

The theory of groups was discovered by Évariste Galois (1811–1832) according to which $T''$ encompasses $T'$, *etc*. But there is no ultimate theory $T''''^{\cdots}$. A reference is made here of Glashow (1975) and

mentioned are André Marie Ampère (1775–1836), Ludwig Boltzmann (1844–1906), James Clerk-Maxwell (1831–1879), Charles Augustin de Coulomb (1736–1806), Albert Einstein (1879–1955), and William Thomson (Lord Kelvin, 1824–1907). One can see perhaps the politics and ambitions of the past in the following quoted words by Samuel Johnson to James Boswell.

> Norway, too, has noble wild prospects; and Lapland is remarkable for prodigious noble wild prospects. But, Sir, let me tell you, the noblest prospect which a Scotchman ever sees is the high road that leads him from Auld Reekie to London.

'Auld Reekie' is the Scottish name of Edinburgh.

Four types of interactions act on different distance scales on body in the Universe. The gravitational force acts over a large distance, the electrical force approximately $10^{-8}$–$10^{-7}$ cm, and both the weak and the strong nuclear forces $10^{-13}$–$10^{-12}$ cm. Developments in Physics is always in the form $x = y$, where $x$ represents theories and $y$ observations. For example, when $y$ was Tycho Brahé's observed position of Mars, and $x$ the theory by Copernicus, which proved not satisfactory, there came another theory by Kepler. When $y$ was the observed rotation of the long axis of the elliptic orbit of Mercury by Simon Newcombe, the $x$ theory by Einstein fits the picture better than that previous one by Newton.

The electromagnetic theory by Maxwell (1864) led to subsequent works by H A Lorentz (1904), H Poincaré, A Einstein, M Planck and H Minkowski (1908.) What these latter did was adding four equations, which led to $E = mc^2$. Lorentz's theory is in a preliminary form while Minkowski's in complete one.

The idea of aether in the nineteenth century proved to be a false path. *Aether* is a Greek word which means invisible jelly. So now, with their later discovery, scientists use nonsense words like 'quark' in order to avoid any cultural associations.

Hoyle talks about Charles Robert Darwin (1809–1882), Johann Carl Friedrich Gauss (1777–1855), Edwin Powell Hubble (1889–1953), Thomas Robert Malthus (1766–1834), Georg Friedrich Bernard Rieman (1826–1866) and Alfred Lothar Wegener (1880–1930).

Galaxies are relatively closer together than stars are to one another. He describes what Hubble has found.

> Galaxies exist cheek-by-jowl compared with stars within a galaxy. In terms of their own scales, stars are widely spaced, where as galaxies are rather closely spaced.

There are altogether, he said, $10^8$–$10^9$ galaxies.

In 1965 A Penzias and R W Wilson detected a uniform radio wave coming from all distance in space. Galaxies form polygons in space. Uniformity means the same shape of polygon, only differing in scale. Measuring the scale, the Universe may expand forever, or there may come contraction after expansion.

Rieman, it seems, has found out that

> The size of atom is determined by the masses of its constituent particles – the larger the masses, the smaller the atoms, the relation being reciprocal.

If one keep the galaxy polygon fixed, then atoms decrease in size with time. This is the first time I have heard anybody put it this way. Accordingly the light from smaller mass of distant galaxy becomes redder. Though Hoyle said he did not believe in God, from what he said above God creates the Universe by creating everywhere each individual atom and particle by increasing their mass from zero to their present values, which still keep on gradually growing. That point of Creation was approximately 15,000 million years ago. If we let that instance be $t = 0$, we may project the time backwards beyond that when masses were negative. Then our Universe is just one domain within the large-scale plus and minus aggregates. The range or our telescope does not even cover the entirety of the domain we are in. Hoyle calls this 'aggregate of mass interactions.' This would be in accordance with Maxwell's theory of the electrical interaction that permits either past-to-future or future-to-past time sequence. And Gauss certainly thought this was the case. Hoyle describes how in 1940's this was the idea of John Wheeler and Richard Feynman.

> They boldly accepted Gauss' idea of a *local* electrical interaction going equally future-to-past and past-to-future. They then argued that the observed asymmetry of cause and effect in the world, past-to-future only, was a *nonlocal* effect arising from the large-scale influence of the whole universe.

Thus,

Time-symmetric local laws
+
Response of the universe
↓
Observed sequence of cause and effect

Hoyle views his steady-state Universe as having matter continually created from antimatter in empty space, and *vice versa* matter into antimatter annihilated. When the time the trigger mechanism is activated is $\Delta t$, the chance that one of the nuclei undergoes change in this time $\Delta t$ is $N\Delta t/\lambda$, where $\lambda$ is the life-time of nucleus.

The Earth was formed 4,500 myBP, that is to say, 4,500 million years Before Present. Long after this it was that existing continents move relative to one another unto this time (*cf* Hoyle, 1972.) As Oparin pointed out, random ordering of amino acids to form proteins will never work quick enough for natural selection according to the theory of Darwin. Therefore life has already existed in space long before the otherwise presumed Big Bang.

As pointed out, the comparative amount of energy we have are $10^{30}$ ergs in total from coal and oil, $10^{31}$ ergs per yer from tides, $10^{29}$ ergs per year from wind, $2 \times 10^{27}$ ergs per year from hydroelectric source. From these figures tides and wind energy may seem to be highly prospective candidates for the necessary, future renewable source of energy but for that the energy required to extract them is too large to be practicable. The energy unit 'erg' is defined such that $1\ \mathrm{kW} \cdot \mathrm{s} = 10^{10}$ ergs. The sunlight absorbed by Earth amounts to $3.4 \times 10^{31}$ ergs/yr and the food eaten by humans is approximately $1.5 \times 10^{26}$ ergs/yr.

According to Malthus population grows in an exponentially increasing smooth curve while productivity does in steps because of the discoveries of one technology after another. Both an energy crisis and isolation of a community produce the same effect of sharply shedding the population.

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# The Tale of Two Sisters

Kit Tyabandha, Ph.D.

I do not know whether one may call the culture of Lanna and Thai brother cultures, but the languages of the same can truely be called sister languages.

'How much of the misunderstanding in this world could have been from nothing other than the difference in the languages'. This is especially true for the two languages which look deceivingly similar otherwise, as examples consider Portuguese and Spanish, American and English.

To me, a language is becoming extinct also when there is no way you could write it down correctly. In the case of Lanna, its system of writing had been falling out of use and there is nothing to replace it with. But now the situation has been reversed, and the Lanna script is making its way back. There is no longer any need for the romanised system of writing like the one I have discovered except (and this is more important in my point of view) in the study of language families.

Even though Lanna is a sister language of Thai, they are different. For one thing, since the Tonal Split which occurred sometimes during the middle period of *Ayudhaya* the number of tones in the former has become six, whereas that in the latter is five.

In theory you could write Lanna using the Thai alphabet quite easily. But several complications hinder this. One of these is the following.

Both Lanna and Thai divide their alphabets into three groups, namely high, middle and low. And their alphabets are mostly the same or similar. But each often puts the same alphabet into a different group from the other.

Seriously this is confusing. For example, you may write the word '*pen*', which approximately means 'to be', is a word in both languages, and you may easily write the Lanna word using the Thai script. But if it is in a Lanna context, you pronounce it not as you would have had it been written as *pén* in Thai. This is because the alphabet *p* is in Thai a Middle Alphabet while in Lanna it is a High Alphabet.

Seriously, this is so strangely confusing. And the normal practice when people write Lanna using the Thai alphabets is that they change the original spelling into *pén* to facilitate the pronunciation.

This is a serious crime to the grammar. On top of this, as a rule, the spelling *pén* in Thai implies that the word is definitely not of the Tai language family origin.

In other words, if you write Lanna using the Thai alphabets and change the tonal symbols to facilitate the reading, then it would seem as though they were unrelated languages. In Thai, for the Middle Alphabets (say *p*), only *pen*, *pěn* and *pèn* can be Thai in origin. *Pēn* is either a foreign word or an onomatopoeia, while *pén* is definitely foreign.

In order to be able to write a grammar book on the Thai language using romanised alphabets, one need to have the transcription system in question first. This is what simply does not exist, not only for Thai but also for Lanna and all the other languages within the Tai family.

# Percolation in Medical Science

Kit Tyabandha, Ph.D.

$2^{nd}$ October 2002

Many diseases can be best thought of as related to percolation when a threshold exists passing the point of which it is difficult to return or to get back to normal. For example a cut may take several weeks to completely heal, but muscular strains could take several years and even then they usually leave a weak spot and thus can not be considered as completely healed. This means that despite the turn over of cells within the fibers of the muscle, the strain still prevail. In other words it has buried itself into the structure of the fiber and no longer is related merely with the individual cells. Not only muscular fibers, but also the brain and the nervous system may be viewed as a kind of networks. Therefore it is not difficult to see many nervous or brain diseases as percolated phenomena. Madness and its onset is an easy example. Deafness, either gradual or sudden, is another one. The difference between a sudden and a gradual onsets of deafness lies in the position of the percolation threshold on the timescale. In the former the network percolates after a period of hidden graduation or deterioration in the condition of the inbuilt sound detector, while in the latter it percolates before the graduation down towards the deafness. Most books on otology talk about sudden onsets of deafness, normally overnight. The reason they are much talked about is more likely to be because of their tragic nature than because they are common. It is interesting to note that the word *otology* means the study of the ears, *-logy* is suffix which comes from the Greek word *logos,* meaning *the study of*, while *ot* or *ōt* means *ear*. It is probably a coincidence rather than a linguistic relationship between the two languages that *oto* is the Japanese word for *sound*.

I should have something to say about the Menière disease because both my previous general physician Dr. Sreedharan and the present one Dr. Chan think that it is what I have. I do not quite agree with them, but if both of them were right and I am wrong then Menière disease results from the accumulation of certain things which then percolates, and I think I know what these things are. This would have been rather a medical breakthrough because all medical textbooks that I have come across anonymously agree that this is a disorder the cause of which is excluded from its definition. In other words all we know about

is what its symptoms are, nobody knows what causes them. What I maintain is this; provided that both of my doctors diagnosed correctly then the cause of it must be percolation. Having said that, I do not think that they did diagnose right, for even though I have both the pressure in the ear and the tinnitus, I never have vertigo. It is true that I have some experience of syncope which is even worse than vertigo, but they are not the same thing. Physicians, however, insist that you must have vertigo no matter if you say you don't, because then they would know that you have the thing called Menière disease the definition of which they do not know anyway! The disease is named after a french physician Prosper Menière who first described it in 1861.

Tinnitus is the constant rumbling or ringing in the ears. The sound can be real and sometimes can be heard by others. Many things can cause it, for example (*cf* Andrews, 1997) excess noise level, alcohol, allergies, antibiotics, blood glucose or blood pressure swing, circulation changes, cranial or jaw-joint misalignment, fever, inflammation, temporomandibular jaw joint diseases, tumours on acoustic nerve. It can also be caused by metallic – aluminium, lead, or mercury – poison. If the cause of it is a prolonged or excessive level of sound, then the process would be similar to that which causes, for instance, the repetitive strain injury.

I will now explain why it should have something to do with percolation. First, I think it is sound or the excess of it which causes the percolation. Next let me give some facts which lead me to the conclusion above. Around the turn of this millennium a friend of mine bought two concert tickets and invited me to join her. Seldom been to a concert, I was delighted. And having noticed that the programme includes a piano recital of one movement from a sonata, probably the fifth, by Scriabin, I decided that I would do my homework in order to gain as much as possible from the concert. At that time I had recently bought the music, a complete sonatas by Alexander Scriabin. They are a total of ten sonatas, and I sat at the piano and read them one by one, day after day. Ten hours a day at the piano was sufficient to give me the obvious sign of an ear problem. For a few days I could not hear anything clearly, and could hardly speak normally. The second sign came not long after I had been to a Community Action conference held in Liverpool. The conference was something new and was very interesting, but I discovered there that young volunteers enjoy too loud a music on the dance floor at night to the cost of my ears. Again the following few days gave me the most alarming feeling, I hardly could hear anything, and whatever sound I heard seemed like coming from the outside to me inside a sealed tank. This together with the

experience of having lived in Bangkok, the city where noise pollution ranks number one, and that of having listened to loud music myself when I was young, have combined to reach the limiting threshold. As I am writing now I still have yet to recover from the second trauma to the ears mentioned. There is a saying that the third time pays for all (*cf* Tolkien, 1955), and so I hope that the third time shall never come considering that the second one has already been this bad and I am in doubt whether I will be able to recover from it. But to me it is clear that this has got something to do with a limiting threshold and thus percolation.

In the case of Beethoven, who also had an ear problem which results in a total deafness, most modern physicians think that the cause was multiple sclerosis, which I also disagree. As a great pianist and a conductor he was exposed to much sound, so I suspect that the latter is also the culprit in his case. It seems an irony that for such people, as well as for myself, music is life and music hurts.

Some thinks of multiple personalities as the fragmentation of the mind or brain (*cf* Keyes, 1999) which causes a person to identify himself as different personalities each of which has its own memory separate from the others. There is a transfer of control at the switching from one personality to another, and all the personalities could use the same body in turn. It is more likely that instead of fragmentation the various personalities are different phases coexisting in the same network of the mind. Like a polyglot or a normal person switching phases among different languages he knows, a person with multiple personalities unconsciously switches himself from one self of his to another. Multiple personalities often report head voices of one self talking to another. These head voices are distinct conversations and thus are different from those experienced by people with schizophrenia. The various personalities have different Electro-Encephalograms, Intelligent Quotients, and psychological test results. This altered state phenomena is normally cured by fusing the personalities together, but some say that the this is not necessary as long as all the personalities are aware of one another. Similar to multiple personalities a person is often said to have good and bad sides, or in some cases selves (*cf* Stevenson, 1886).

We still do not understand much about sleep, that state where the mind finds itself in phases which are different from the awaking self. No one seems to know why it is necessary that we sleep at all, but all animals sleep, or die if they are deprived of it. Dolphins sleep one hemisphere of the brain at a time. Sleep and wakefulness are two different phases of the mind, and the sleep itself may contain more than

one phase. The transitions back and forth among these various phases are the same as the changes of phases characteristic to percolation. A person normally has several dreams while he sleeps, but only the immediate one from which he is wakened up is remembered. This may mean that during sleep the mind is switched among various phases, or it may mean that in sleep the mind only has a short-term memory.

Subconscious mind can sometimes come to the front. This often happens when the conscious mind becomes weak. When a man becomes drunk, for instance, he may be able to find his way home only to wake up the following morning, sober and wondering how he has got there. This is because in the drunken state his mind becomes muddled up by the effect of alcohol that the subconscious mind took control to lead him home unconsciously. Multiple personality represents the fragmentation of the subconscious mind into virtual clusters each of which then alternately comes to the front to parade as a person. These clusters are probably superimposed in three or higher dimensions, without overlapping one another, in a way similar to the intertwining of clusters in a three-dimensional Voronoi network. The change of personality in this case is then a transfer from one phase to another. The first and most important fragmentation which leads towards a multiple personality seems to happen only in children at around the age of three, when the mind is in the forming and the language of the mind is predominantly geometrical, while later and minor fragmentations are possible much later afterward. Our minds during sleep seem to be another layer separate from and exists below both the conscious and all fragments of the subconscious mind, as can be seen by the fact that a person with multiple personalities also needs to sleep. Some of the most fearsome and the least understood sicknesses like Parkinsonism and Encephalitis Lethargica, or the sleeping sickness, affects only the conscious part of the mind, not the higher faculties of the unconscious part (*cf* Sacks, 1973). One of the effects of the medicine laevo-dihydroxyphenylalanine, or L-DOPA, seems to be that of letting the subconscious mind take over to motor functions. The condition of the patients usually improves quickly soon after first put on the medicine, then overshoots a stable condition and shows adverse effects of the medication which are no less gruesome than the symptoms before starting to take the drug. These counter symptoms probably occurs in Control Systems as an overshoot in the output in response to a step function which represents the usual constant daily dosage used. Because such undesirable symptom occurs in most cases, dosage should either be reduced before the overshoot occurs in accordance with the empirical time constant of the response, or increased very gradually from zero at the beginning in order to reach the steady state be reached without an overshoot, as an analogous to an over- or critically damped control scheme. One of the most intriguing

effects of too much use of L-DOPA is that primitive, sometimes subhuman, behaviours could be brought to the front while the patient himself can only stand back as a witness to his own self without being able to do anything to stop them.

In the art and science of Neurology there is no lack of phase transition phenomena. So much so that symptoms normally come in pairs of opposing poles, for example aboulia – hyperboulia, automatism – command-negativism, bulimia – anorexia, and perseveration – block. Within these pairs the poles may switches suddenly as can be seen in kinexia paradoxa, the explosive transition between hyperkinesia and akinesia. Somewhere between the two poles lies our normal conditions. In many of post-encephalitic patients taking L-DOPA, this middle ground which starts off very wide can rapidly shrink until the patients find themselves balancing on the edge of a knife and it becomes impossible to calibrate the drug to the right amount.

# On My Past Writings

Kit Tyabandha, Ph.D.

$2^{nd}$ October 2002

## Cyberspace

In 1983 Apple computers had been installed in number at the Ashburton College, New Zealand, where I was doing my Sixth Form as an American Field Service exchange student, and Pascal was taught. In 1993 I worked as a Security Officer for the TelecomAsia Company in Thailand. My job was to look after data on the three mainframe computers in use. It was there that I learnt terms like *cyberspace* and *hackers*. I became fascinated by this idea, that there is a virtual space tessellated into partitions which house a population whose identity is related to real people, because to me it is a whole new dimension added to the existing ones. Starting doing my master degree in Control and Information Technology at UMIST in 1994, I came in closer touch with the cyberspace community through the use of Unix is the first thing taught in that course. I voluntarily wrote two articles on the subject, the first one is about cyberspace (Tiyapan, 1994) and the second one about its security (Tiyapan, 1996d).

## Sociology

The nature of discoveries and progresses in science is according to Bacon (Francis Bacon, 1620) *a birth of Time rather than a birth of Wit*. This is the same idea of percolation and the description he gave is the very picture of the theory. According to him major scientific progresses come in revolutions which are sparsely distributed in both time and regions. There have only been three periods of major progress out of the *five and twenty centuries over which the memory and learning of men extends*, namely the Greeks, the Romans and the nations of Western Europe. These are narrow limits of time, the periods in between of which are unfavourable to development. A discovery or an invention, then, comes as a chance accident in the scale of an individual, and as a certainty when looking from a distance.

When the time is right and all the hidden momentum built up, theories will come on by itself as a rule. This does not negate the

excellence of an individual, but in a society where there are enough multitude of individuals the show will always go on, with or without a particular genius. This idea can very well explain cases of multiple discoveries. According to Kekulé in his *Benzolfest* speech in 1890, when he ascribed his conception of the cyclic nature of Benzene in dreams, *certain ideas at certain times are in the air* and *if one man does not enunciate them, other will do so soon afterwards*.

To see the relationship of this with percolation it is possible to look at two different things in turn, first at the discoveries and then at the discoverers. With a unit being that of a *discovery* the connection to percolation is that big discoveries come as connections of other smaller and less obvious ones. A theory often has more than one perspective, and which one of them comes to the fore first depends much on which combination happens to percolate through first. The discoveries of Schrödinger and Heisenberg in Quantum Physics can bear witness to this both in the *combination* and the *multiple discoveries* parts of this argument.

Let us turn our attention now to the scientist and look at the one who does the discovering instead. The theory of percolation tells us that at the point of discovery he is by no mean the sole integral ingredient. If he does not do it, then someone else will certainly do. In order to see this, I did four simulations for the cell, bond, vertice, and edge percolations on a two-dimensional Voronoi network and then another four with the same respective blockage of each case but considering the inverse phase instead. The number of units considered for the four cases are $n_c = 200$, $n_b = 416$, $n_v = 298$, and $n_e = 426$. With the order of simulations as described above, at just one step before percolation occurs there are respectively 10.6, 13.4, 11.5, 1.1, 11.24, 10.0, 19.4, and 7.9 percents among the remaining units which will readily trigger the onset of percolation. In other words, these are atoms which are able to link up existing clusters and form a percolating cluster.

The formation of mobs is an interesting phenomenon comparable with phase change in physics. What happens is that an agglomerate of individuals becomes one and a single creature, the underlying mechanism of which still baffles any effort towards understanding it. Likely enough it has got something to do with psychology and the mind. But to me at least, the phenomenon is percolative. Having gained some acceptance from my previous writings (Tiyapan, 1995, 1996a, 1996b) I gave my new work which briefly discusses the mechanism underlying the formation of mobs to an editor of the Sakkayaphab journal whom I know. At that time a political turmoil unequal in its degree and extent

has been going on for five years. Whether by fate or by design there has been a successful but tragic use of mob in Bangkok. The word *mob* has joined the list of those synonym to *distrust*, namely *communist* or, in western community now for that matter, *Islam* and *evil*. Whether because of this or something else, the article (Tiyapan, 1996c) simply and mysteriously got lost; no one would admit having seen it, and the translation of another subsequent article of mine (Tiyapan, 1996d) has not been without a noticeable negligence. Thus to me distrust is also percolative. The list of things one finds over-distrusted without reasonable explanation goes on indefinitely, homosexuality, communism, *etc*. The same seems to be the case with bad habits. My father used to teach me using the following poem,

> Bad habit gathers by unseen degree
>
> like brook makes river, river runs to sea.

Looking back, it could have been the title of that article, *on pragmatists and idealists*, which has somehow convinced the editors into believing that it was political which to me is nonsensical. I only meant literary, even if at times philosophical. I include it here because it contains a curve showing a critical emotional transition.

The formation of the United States, the European Union, or the Commonwealth comes from the trust which acts to join countries together like glue boxes in TEX. Like all binding forces, trust is mutual and spreads in the same way as a growing cluster does. The cluster grows bigger as one or more members are added, and it becomes stronger as the level of the mutual trust increases. In a similar way, distrust is also mutual and also spreads. If I distrust you and you distrust me, I will make sure that I remain as far away from you as possible while you will certainly avoid me by all means in return.

Only these two are possible, so there are only two phases to consider, that of trust and distrust. The relationship where one trusts while the other distrusts would not be stable, since the former will soon learn to join the latter. Trust forms clusters of one phase, distrust another. The size of these clusters vary in a way similar to those in percolation of geometrical networks. The strength of the glue is analogous to the probability either of becoming or remaining a member of a cluster.

The rise of dictators, the proliferation of weapons of mass destruction, *etc*, these things I believe are the products of changes of something hidden within the underlying structure. Unless we find out what is

happening in the background, these things will unavoidably occur. I believe that this unseen thing behind the scene is governed by some phenomena similar to that of percolation. I think that the key towards understanding many unexplainable phenomena is to investigate, in the light of the percolation theory, the working of agglomeration of countries or states like those of the United States and the European Union.

The believe that scientific discoveries are a birth of time, rather than of wit (*cf* Larsen, 1993), is the same as the idea of percolation. We know because we remember. And all the various discoveries of our time together with the knowledge we possess of the past bring us closer to another discovery. Scientific discoveries, then, is the collective product of humanity rather than property of a single person (*cf* Merton, 1965).

And because all species are also the product of percolation in time, our knowledge and consciousness, too, are the product of the universe. One may say that it is a personification when we refer to a collective noun, for instance a mob, as an individual. But the truth is that, under the percolation theory, it is in fact a separate individual without any need for the use of a simile. The renormalisation group theory tells us that there exists a structure in a bigger scale that behaves like the individual components that comprise it. It seems, therefore, that for humans these collective beings of ours are still primitive compared with each of us as an individual. This is the reason why, whenever we come together, we alway make wars. In our case, then, we seem to be conscientiously percolated only individually not collectively. In the case of bees, on the other hand, it is the other way round. This is why a colony of bees does things which make far better sense than a bee does. But one can not say that even a *colony* of bees has consciousness, because there seems to be no morals in what it does. I do not know whether there are other beings in the universe both the collective and individual beings of whom have percolated conscientiously. But I believe they exist, in which case they should be more intelligent than us, though this is by no means necessarily the case.

## Control Systems

The following are relevant subjects in control systems. I have one first degree and one master degree in the subject. From 1995 to 1999 I did a doctorate course in Tokyo but decided to quit after three years. Research in this area is still one of the topics that I would like to do in the future. One year before leaving Japan my research results must have look quite well because on $22^{nd}$ April 1998 my supervisor Professor

Katsuhisa Furuta wrote me an email which says, 'Your reports are very nice! Excellent results. I am verymuch [sic] impressed. We can talk the results.', signed 'Furuta'. And again on $2^{nd}$ June 1998 another email, 'Dear mr.kit [sic] please come and explain your synchronous motor. Where shall we introduce the controller?', signed 'Katsuhisa Furuta'.

Although it is true that control systems is always used in military and missiles, one must not forget that it is also important for travelling in space and is likely to be of a great help to those space settlers searching for habitable planets in the future. Control system is used much in electrical, mechanical, and chemical engineering, with the typical time constant increasing in that order.

This section is in a way a brief recapture of what I did during my PhD study at TIT, Japan. I collected my works in a form of Technical Reports and gave a copy each to Professor Furuta who was my supervisor then. Sometimes when there was a spare copy left I would give it to another senior staff who worked in the Minami 5 building where the Furuta lab used to be. The computer files of these reports is no longer available even to myself. A great number of figures from simulation results in these reports are not reproducible here without the Simulink facility on Matlab. The first of such report was dated $16^{th}$ July 1998 but the works it contains started around the beginning of April of the same year. I studied systems listed in a book by Khalil (1996). One of these systems (Exercise 1.17 (4)) is

$$\dot{x}_1 = x_1 + x_2 - x_1\left(|x_1| + |x_2|\right), \tag{1}$$
$$\dot{x}_2 = -2x_1 + x_2 - x_2\left(|x_1| + |x_2|\right) + u, \tag{2}$$

where $u$ is the input to the system and $x_1$ and $x_2$ the state variables. Because the simultaneous equations $x_1 + x_2 - x_1\left(|x_1| + |x_2|\right) = 0$ and $-2x_1 + x_2 - x_2\left(|x_1| + |x_2|\right) = 0$ are ill-formed, there can be no equilibrium points.

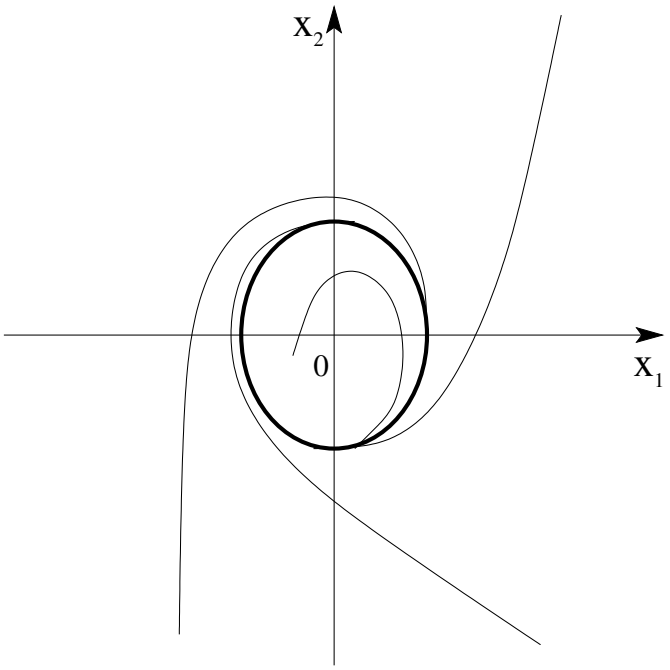
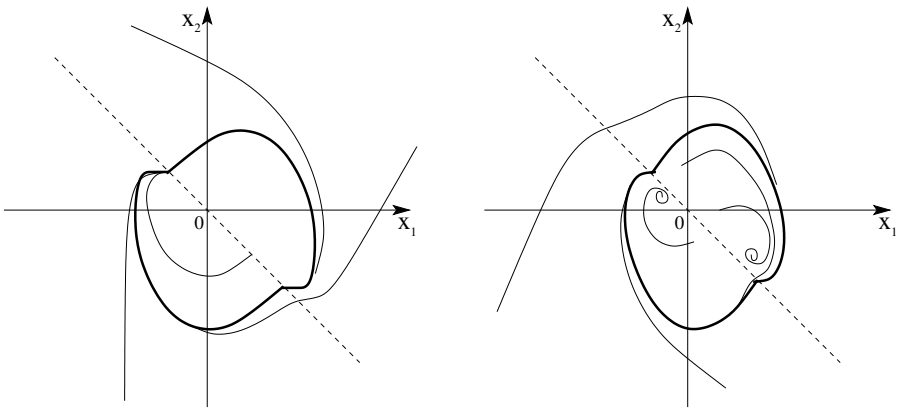



**Figure 1** *Phase plane of Equations 1 and 2 with no input*

In Figure 1 is shown the phase plane of the system described by Equations 1 and 2 when there is no input. The limit cycle in Figure 1 is elliptical with the major axis along the $x_2$-axis. When the control input is $u = \text{sgn}(x_1 + x_2)$ the phase plane looks like Figure 2 (a) and when $u = -(x_1 + x_2) + \text{sgn}(x_1 + x_2)$ Figure 2 (b).




(a) (b)

When there is no control Figure 1 shows that the equilibrium point at the origin is an unstable focus and there is a limit cycle circling around the origin. This limit cycle is slightly larger in the $x_2$ direction than in the $x_1$ direction. Every trajectory starting from an initial point other than the origin goes to and then stays on this limit cycle. With the control input $u = \text{sgn}(x_1 + x_2)$ there is a discontinuity on the surface of the hyperplane $s = x_1 + x_2 = 0$. All trajectories still converge to the limit cycle although the latter is distorted where it intersects the hyperplane. There is no node and every point on the hyperplane and inside the limit cycle is an unstable node. All these also hold when the control input is $u = -(x_1 + x_2) + \text{sgn}(x_1 + x_2)$ and there are two additional nodes as shown in Figure 2 (b).

During September and October 1996 I gave a series of seminars on a topic related to polytopes of polynomials. The topic I chose was recent (Pujara, 1996) and rather difficult for me but for me it was a success because the methods introduced was discussed weekly for at least a month in a series of the subsequent seminars, and they resulted in the idea being successfully applied, in the context of Pulse Width Modulation, by one of the students who attended in his Ph.D. work.

The following is a recapture of the original seminar I gave. The discussions, which was the most interesting part in these seminars, are lost. A pseudoboundary is defined to be the set of all polynomials in the polytope each of which has at least one zero on the imaginary axis. A section of the pseudoboundary corresponding to $\omega_0$ is a polytope whose vertices lie in the exposed 2-d faces of the given polytope. Pujara (1996) in his study of the stability boundary problem gave an algorithm to generate all the vertex polynomials of any section of the pseudoboundary of a polytope. A polytope is stable if and only if its exposed edges are stable. Interval polynomials are a hyperrectangle in coefficient space with edges parallel to the coordinate axis. Kharitonov's results is that if a polynomial family consists of interval polynomials, then the stability of just four extreme polynomials is both necessary and sufficient for the stability of the entire rectangle. Consider the polynomial $f(s,q) = s^n + a_1(q)s^{n-1} + a_2(q)s^{n-2} + \ldots + a_{n-1}(q)s + a_n(q)$ which produces an $r$-dimensional polytope $P$ in $R^{n+1}$. Here $a_i(q)$, $i = 1$ to $n$, are real affine coefficients and $q_i^- \leq q_i \leq q_i^+$ for every $q_i$, $1 \leq i \leq r$. For fixed $q$, this polynomial is a point in $R^{n+1}$ whose coordinates are the coefficients of the polynomials. The pseudoboundary, $\beta$, is the set of polynomials in the polytope $P$ each of which has at least one zero on the imaginary axis. The section, $\beta_0$, of $\beta$ at $\omega_0$ consists of those polynomials each of which has a zero at $j\omega_0$. If $Z \in C^{n+1}$ is a set of all zeros of this polynomial, then $\omega_0 \in W$ if and only if $\exists g(j\omega_0) \in P$ such that $g(j\omega_0) = 0$. Every $\beta(j\omega_0)$ is a polytope which has its vertices on the exposed 2-d faces of $P$, which in turn can be explicitly determined.

**Theorem.** *(Pujara, 1996) The section of the pseudoboundary $\beta$ of a polytope $P$ at any frequency $\omega_0$ is a polytope. The vertices of this pseudoboundary lie in the exposed 2-d faces of the polytope $P$.*

The state equations of a dc motor are

$$J\frac{d\omega}{dt} = ki \tag{3}$$

$$L\frac{di}{dt} = -k\omega - Ri + u \tag{4},$$

where $i$ is the armature current, $u$ the voltage, $R$ the resistance, $L$ the inductance, $J$ the moment of inertia, and $\omega$ the angular speed. The constant excitation flux $\phi$ results in the torque $ki$ and the back e.m.f. $k\omega$.

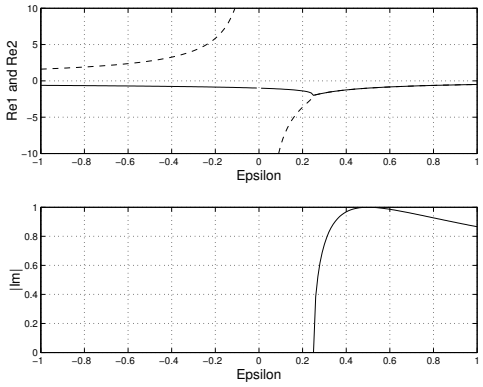



**Figure 4** The eigenvalues of the dc motor as a function of $\varepsilon$..

My technical report number 6 (1998) I studied the control of synchronous machines. In the introduction I wrote to Professor Furuta to say that he may use any of the material without acknowledging me. I see it fits to describe briefly here some of the results because I initiated and carried out the work, as is normally the case with most of my researches done while in Japan. The electrical frequency of such machines synchronises with the mechanical speed. However it is more convenient to express angles in electrical unit, *i.e.* electrical angle, rather than in mechanical unit, *i.e.* mechanical angle, for the reason that a synchronous machine can have more than two poles. Whichever is the case, one may consider only a single pair of poles and then consider the electrical, mechanical, and magnetic conditions, which are associated with all the other pole pairs as repetitions of those for the pair being considered (*cf* Fitzgerald *et al*, 1971).

The electrical and the mechanical angles of a generator are related by the relation $\theta_e = \frac{p}{2}\theta_m$, where $\theta_e$ is the electrical angle of the output, $\theta_m$ is the angle of the rotating shaft, and $p$ is the number of poles of the machine. The frequency of the voltage is $f = \frac{p}{2}\frac{n}{60}$ Hz, where $n$ is the mechanical speed in rpm and $\frac{n}{60}$ the speed in revolution per second. The radian frequency $\omega$ of the voltage is $\omega_e = \frac{p}{2}\omega_m$, where $\omega_m$ is the mechanical speed in radian per second.

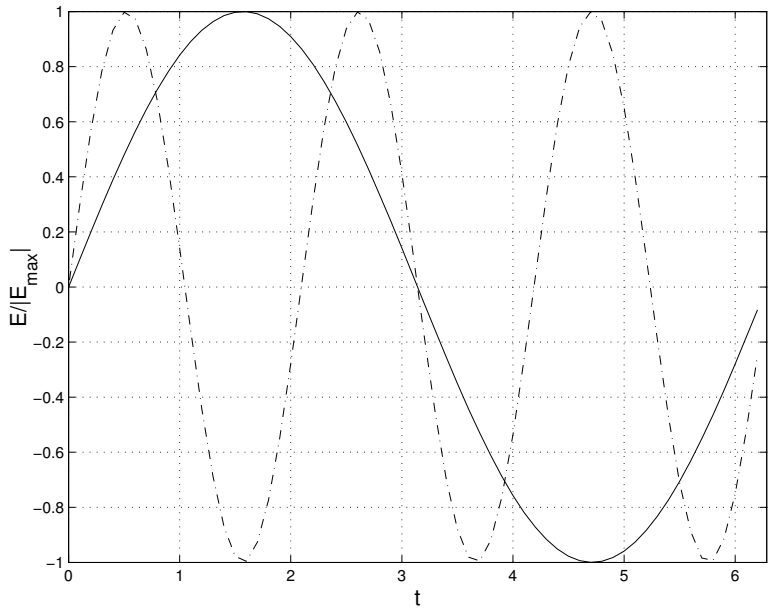



**Figure 5** *Dynamics of the mechanical and the electrical angles*

Figure 5 shows the dynamics of the mechanical and the electrical angles of a synchronous machine with three pair of poles. The solid line is the mechanical, while the dash-dot line the electrical rotation. The mechanical and the electrical rotation of a synchronous machine are juxtaposed in Figure 5. In power system engineering one wants to control the power and the frequency. Examples of controllers are speed governors, actuators, regulators, and signal transducers. Speed governors can be described by $\Delta f \cdot K = T_L$, where $\Delta f$ is the change in frequency, $K$ the gain, and $T_L$ the load torque. The other controllers mentioned are high-gain power-amplifiers which convert things like position, oil pressure, and electricity into valve positions.

The change in load in the power-frequency control of a synchronous generator can either be a *load shedding* where the load decreases causing the frequency to increase, a *generator shedding* where the load increases causing the frequency to decrease, or a *short circuit* where the generator is suddenly disconnected and as a result the frequency increases to the maximum value. The effects caused by the load change are related to the equation $J\frac{\mathrm{d}^2\theta}{\mathrm{d}t^2} = T_{PM} - T_E$, where $J$ is the moment of inertia of the rotating mass, $\theta$ the angular position of the rotating mass, $T_{PM}$ the prime-mover torque, and $T_E$ the electrical torque.

In 1998 I presented a paper (Tiyapan, 1998) at the ATAC-98 conference in Japan. The objectives of that study are to study the effects of a sign function input, to study the effects of $\varepsilon$ in a singularly perturbed system, and to study a variable structure singularly perturbed system in other words those which have a sign function in the control input. *Singular perturbation* of any system implies that it has $\varepsilon_i$ terms multiplying the term $\dot{\mathbf{x}}$ and that these terms $\varepsilon_i$ approach zero. One can write down a given transfer function $T(s)$ in the state space forms $\dot{\mathbf{x}} = \mathbf{E}^{-1}\mathbf{A}\mathbf{x} + \mathbf{E}^{-1}\mathbf{B}\mathbf{u}$ and $y = \mathbf{C}\mathbf{x} + D$. For example, $T(s) = \frac{2(s+5)(s^2+4s+29)}{(s+10)(s+1)(s^2+8s+20)}$ can be represented by the above state equations with

$$\mathbf{A} = \begin{bmatrix} -8 & -5 & 1 & 1.25 \\ 4 & 0 & 0 & 0 \\ 0 & 0 & -11 & -2.5 \\ 0 & 0 & 4 & 0 \end{bmatrix}, \quad \mathbf{B} = \begin{bmatrix} 0 \\ 0 \\ 2.82843 \\ 0 \end{bmatrix}, \quad \mathbf{E} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix},$$

$$\mathbf{C} = \begin{bmatrix} -2.83 & 1.6 & 0.71 & 0.88 \end{bmatrix}, \quad \text{and} \quad D = 0.$$

Then if we rewrite $\mathbf{E}$ as

$$\mathbf{E} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & \varepsilon \end{bmatrix},$$

we can study the perturbation effect of the singularly in $\varepsilon$ as it decreases from $\varepsilon < 1$ towards $\varepsilon \ll 1$, namely

$\varepsilon = 0.5$,

$$T(s) = \frac{2(s+10)(s^2+4s+29)}{(s^2+8s+20)(s+2.2984)(s+8.7015)}$$

$\varepsilon = 0.1$,

$$T(s) = \frac{2s^3+108s^2+458s+2900}{(s^2+8s+20)(s^2+11s+100)}$$

$\varepsilon = 0.01$,

$$T(s) = \frac{2s^3+1008s^2+4058s+29000}{(s^2+8s+20)(s^2+11s+1000)}$$

$\varepsilon = 0.001$,

$$T(s) = \frac{2s^3+10008s^2+40058s+(2.9\times 10^5 2.9)}{s^4+19s^3+10108s^2+80220s+(2\times 10^5)}$$

$\varepsilon = 0.0001$,

$$T(s) = \frac{2s^3+100008s^2+400058s+(2.9\times 10^6)}{s^4+19s^3+(1.0011\times 10^5)s^2+(8.0022\times 10^5)s+(2\times 10^6)}.$$

To summarise the root locus behaviour when $\varepsilon$ decreases, two complex zeros are fixed, that is $s^2 + 4s + 29$. Two complex poles described by $s^2 + 8s + 20$ remain the same throughout. The zero on the real axis moves left. The two poles on the real axis moves toward each other. At the point when the moving zero passes the pole on its left hand side the root locus changes its characteristics.

Even as early as November 1998 I have decided that Control Systems will not be the only area that I will do researches in, as can be seen in the title of the technical report number two (1998) which has the words *system and control* put in brackets. Here among other things I considered the system described by the differential equation

$$\varepsilon \frac{\mathrm{d}^2 x}{\mathrm{d}t^2} + \frac{\mathrm{d}x}{\mathrm{d}t} = u \tag{5}$$

. This can be rewritten as the state equations $\dot{x}_1 = x_2$ and $\varepsilon \dot{x}_2 = -x_2 + u$ which represent a model in the *standard form* since the second equation has a real isolated root when $\varepsilon = 0$. By letting the right hand side of the state equation be zero, every point on the $x_1$ axis is an equilibrium point. A model described by the equations $\dot{x} = f(t, x, z, \varepsilon)$, $x \in R^n$ and $\varepsilon \dot{z} = g(t, x, z, \varepsilon)$, $z \in R^n$ is said to be in the standard form if and only if $0 = g(t, x, z, 0)$ has $k$ isolated real roots $z = h_i(t, x)$, $i = 1, 2, \ldots, k$ (Khalil, 1996); then these two equations reduces to a *quasi-steady state* or *slow model* $\dot{x} = f(t, x, h(t, x), 0)$.

For the present system the eigenvalues obtained from the Jacobian matrix $A = \left.\frac{\partial f}{\partial x}\right|_{x=(x_1,0)} = \begin{bmatrix} 0 & 1 \\ 0 & -\frac{1}{\varepsilon} \end{bmatrix}$ are 0 and $-\frac{1}{\varepsilon}$. Therefore it has an equilibrium subspace and the qualitative behaviour of the trajectories depends on the values of $\varepsilon$, that is when $\varepsilon > 0$ all trajectories converge to the equilibrium subspace, when $\varepsilon = 0$ the system degenerates and is reduced to a first order system, and when $\varepsilon < 0$ then all trajectories diverge from the equilibrium subspace. In other words the system is stable when $\varepsilon > 0$ and unstable when $\varepsilon < 0$. By plotting the state planes and the time response of the state variables of this system when $u = 0$, one can see that the system is stable if $\varepsilon > 0$, and unstable if $\varepsilon < 0$. When $|\varepsilon|$ becomes smaller the response of the system becomes more rapid as $\dot{x}_2 = \frac{1}{\varepsilon} x_2$ rapidly converges to its root $x_2 = 0$ when $\varepsilon$ approaches zero. The trajectory is a straight line which becomes more parallel to the $x_2$-axis the closer $\varepsilon$ gets to zero.

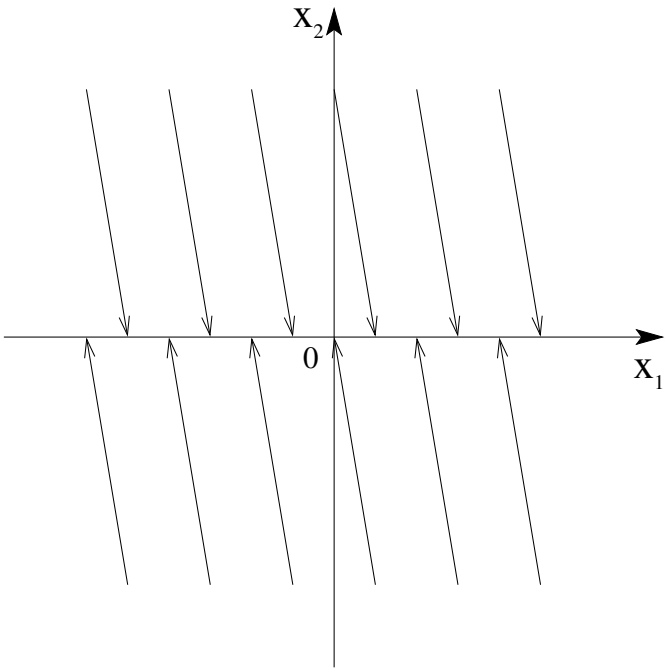



**Figure 6** *State plane of the system* $\varepsilon \mathrm{d}^2x/\mathrm{d}t^2 + \mathrm{d}x/\mathrm{d}t = u$ *with* $0 < \varepsilon < 1$

As $\varepsilon$ approaches zero and $u = 0$ the system becomes $x_2 = 0$ or $\dot{x}_1 = 0$ which has the solution $x_1(t) = x_1(0)$ and $x_2(t) = 0$. The singular point $\varepsilon = 0$ is the point of discontinuity since the solution is stable when $\varepsilon \to 0^+$ and unstable when $\varepsilon \to 0^-$.

Next study the effect of a feed back with the sign function, $u = K\,\mathrm{sgn}(Cx_1 + x_2)$, to the system in Equation 5, where $C$ and $K$ are real

constants. When $C = K = 1$, simulation results showed that the response of the controlled system changes more rapidly as $|\varepsilon|$ becomes smaller. In other words, the response becomes faster as $\varepsilon$ approaches zero. This increase in speed of the response as $\varepsilon$ decreases in magnitude applies for the unstable case where $\varepsilon < 0$ as well as when $\varepsilon > 0$.

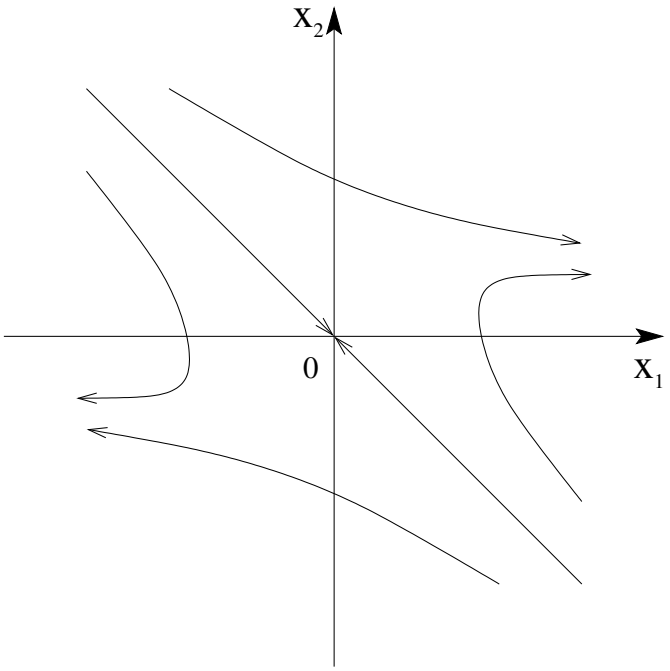



**Figure 7** *State plane of* $\varepsilon \mathrm{d}^2x/\mathrm{d}t^2 + \mathrm{d}x/\mathrm{d}t = \mathrm{sgn}(x_1 + x_2)$ *when* $\varepsilon \geq 1$

The boundary layer or the transient period of the system remains

the same either with or without the input, that is $t$ of approximately $[0, 0.05]$ and $[0, 0.4]$ for $\varepsilon = 0.01$ and $0.1$ respectively. For $\varepsilon \geq 1$ this boundary layer extends beyond one second. With the feed back input, the state plane trajectory reaches the line $x_2 = 0$ during the transient period and then gently slides along it.

The state equations with the input become $\dot{x}_1 = x_2$ and $\varepsilon\dot{x}_2 = -x_2 + \text{sgn}(x_1 + x_2)$. When $\varepsilon = 0$ the latter equation above becomes $0 = -x_2 + \text{sgn}(x_1 + x_2)$ which gives the root $\bar{x}_2 = \text{sgn}(\bar{x}_1 + \bar{x}_2)$ that can not be written in the form $\bar{x}_2 = h(t, \bar{x}_1)$. This means that the equation has no isolated root and consequently one can not isolate the fast mode from the slow mode by introducing a new variable $y = x_2 - h(t, x_1)$. But for the purpose of finding the boundary layer model, let $h(t, x_1, x_2) = \text{sgn}(x_1 + x_2)$. Then $y = x_2 - h(t, x_1, x_2) = x_2 - \text{sgn}(x_1 + x_2)$ and as a consequence $x_2 = y + \text{sgn}(x_1 + x_2)$. Introduce a new time variable $\tau$ obtained from $\varepsilon\frac{\text{d}y}{\text{d}t} = \frac{\text{d}y}{\text{d}\tau}$ or $\frac{\text{d}\tau}{\text{d}t} = \frac{1}{\varepsilon}$ when $\tau_0 = 0$, that is $\tau = \tau_0 + \int_{t_0}^{t} t\text{d}t = \frac{t - t_0}{\varepsilon}$. This new time variable $\tau$ is generally known as the *stretched* time variable. Then the equation $\varepsilon\left[\frac{\text{d}y}{\text{d}t} + \frac{\text{d}}{\text{d}t}\text{sgn}(x_1 + x_2)\right] = -y$ becomes $\frac{\text{d}y}{\text{d}\tau} + \frac{\text{d}}{\text{d}\tau}\text{sgn}(x_1 + x_2) = -y$. Substituting $x_2 = y + \text{sgn}(x_1 + x_2)$ gives $\frac{\text{d}y}{\text{d}\tau} = -y - \frac{\text{d}}{\text{d}\tau}\text{sgn}(x_1 + y + \text{sgn}(x_1 + x_2))$, and therefore the boundary layer model is $\frac{\text{d}y}{\text{d}\tau} = -y - \frac{\text{d}}{\text{d}\tau}\text{sgn}(x_1 + x_2 + 1)$ when $x_1 + x_2 > 0$, is $\frac{\text{d}y}{\text{d}\tau} = -y - \frac{\text{d}}{\text{d}\tau}\text{sgn}(x_1 + x_2)$ when $x_1 + x_2 = 0$, or is $\frac{\text{d}y}{\text{d}\tau} = -y - \frac{\text{d}}{\text{d}\tau}\text{sgn}(x_1 + x_2 - 1)$ when $x_1 + x_2 < 0$. When $\bar{x}_1 + \bar{x}_2 > 0$ then $\bar{x}_2 = +1$ and the reduced problem becomes $\dot{x}_1 = +1$. Likewise when $\bar{x}_1 + \bar{x}_2 = 0$ then $\bar{x}_2 = 0$ and $\dot{x}_1 = 0$, and when $\bar{x}_1 + \bar{x}_2 < 0$ then $\bar{x}_2 = -1$ and $\dot{x}_1 = -1$.

The discontinuous nature of the signum function makes the analysis of the variable structure control system difficult. This is due to the fact that one can not analytically find $\frac{\partial\,\text{sgn}\,x(t)}{\partial t}$, $\frac{\partial\,\text{sgn}\,x(t)}{\partial x_i}$, where $i = 1, 2, \ldots, n$ and $x(t)$ is an $n$-tuple vector. One way to overcome or go around this problem is to use a numerical approximation for the sign function where necessary.

Let the input be $u = -(x_1 + x_2) + \text{sgn}(x_1 + x_2)$, then simulations show that the system has two timescales, which is the characteristic of a singularly perturbed system. Having a fast response within the boundary layer and a slow response elsewhere, the boundary layer becomes narrower and the response faster as $\varepsilon$ approaches zero from above ($\varepsilon \to 0^+$). Also, numerical studies shows that this boundary layer, in seconds, is approximately $[0, 0.05]$, $[0, 0.23]$, and $[0, 0.54]$ respectively when $\varepsilon$ is 0.01, 0.1, and 1. With this input, the equations of the system become $\dot{x}_1 = x$ and $\varepsilon\dot{x}_2 = -x_1 - 2x_2 + \text{sgn}(x_1 + x_2)$. The last equation

becomes $= 0 - x_1 - 2x_2 + \operatorname{sgn}(x_1 + x_2)$ when $\varepsilon = 0$, in other words $x_2 = -\frac{1}{2}x_1 + \frac{1}{2}\operatorname{sgn}(x_1 + x_2)$. To find the boundary layer, change the variable $x_2$ to $y = x_2 - x_2|_{\varepsilon=0} = x_2 + \frac{1}{2}x_1 - \frac{1}{2}\operatorname{sgn}(x_1 + x_2)$. Therefore $x_2 = y - \frac{1}{2}x_1 + \frac{1}{2}\operatorname{sgn}(x_1 + x_2) = y - \frac{1}{2}x_1 + \frac{1}{2}\operatorname{sgn}\left(x_1 + y - \frac{1}{2}x_1 + \frac{1}{2}\operatorname{sgn}(x_1 + x_2)\right)$. Which is essentially that $x_2$ equals $y - \frac{1}{2}x_1 + \frac{1}{2}\operatorname{sgn}(y + \frac{1}{2}x_1 + \frac{1}{2})$ when $x_1 + x_2 > 0$, $y - \frac{1}{2}x_1 + \frac{1}{2}\operatorname{sgn}(y + \frac{1}{2}x_1)$ when $x_1 + x_2 = 0$, and $y - \frac{1}{2}x_1 + \frac{1}{2}\operatorname{sgn}(y + \frac{1}{2}x_1 - \frac{1}{2})$ when $x_1 + x_2 < 0$. Substitute this into the equation for $\varepsilon\dot{x}_2$ above to get the boundary layer model $\varepsilon\left[\frac{\mathrm{d}y}{\mathrm{d}t} - \frac{1}{2}\frac{\mathrm{d}x_1}{\mathrm{d}t} + \frac{1}{2}\operatorname{sgn}(x_1 + x_2)\right] = -2y$ or $\varepsilon\left[\frac{\mathrm{d}y}{\mathrm{d}t} - \frac{y}{2} + \frac{1}{4}x_1 - \frac{1}{4}\operatorname{sgn}(x_1 + x_2) + \frac{1}{2}\operatorname{sgn}(x_1 + x_2)\right] = -2y$. Use the stretched time variable $\tau$ introduced above. Then $\frac{\mathrm{d}y}{\mathrm{d}\tau} = -\frac{3}{2}y - \frac{1}{4}x_1 - \frac{1}{4}\operatorname{sgn}(x_1 + x_2)$, which is the same as saying that $\frac{\mathrm{d}y}{\mathrm{d}\tau}$ equals $-\frac{3}{2}y - \frac{1}{4}x_1 - \frac{1}{4}$ when $x_1 + x_2 > 0$, $-\frac{3}{2}y - \frac{1}{4}x_1$ when $x_1 + x_2 = 0$, and $-\frac{3}{2}y - \frac{1}{4}x_1 + \frac{1}{4}$ when $x_1 + x_2 < 0$.

Now for a variable structure control, let the hyperplane be described by $s = cx_1 + x_2$ whose derivative is $\dot{s} = c\dot{x}_1 + xd_2$. Let the input be $u = -K\operatorname{sgn} s = -K\operatorname{sgn}(cx_1 + cx_2)$ for $K \in R^+$. Choose a Lyapunov function as $V = \frac{1}{2}s^2$. The state equations become $\dot{x}_1 = x_2$ and $\dot{x}_2 = -\frac{1}{\varepsilon}x_2 - \frac{K}{\varepsilon}(cx_1 + x_2)$. The derivative of the Lyapunov function is then $\dot{V} = s\dot{s} = (cx_1 + x_2)\left(cx_2 - \frac{1}{\varepsilon}x_2 - \frac{K}{\varepsilon}(cx_1 + x_2)\right) = c^2x_1x_2 - \frac{cx_1x_2}{\varepsilon} + cx_2^2 - \frac{x_2^2}{\varepsilon} - \frac{cKx_1}{\varepsilon}\operatorname{sgn}(cx_1 + x_2) - \frac{Kx_2}{\varepsilon}(cx_1 + x_2)$. In order to observe the effect of $\varepsilon$ on the stability of the controlled system, let $c = 2.7$ and $K = 3.3$. From plots of $\dot{V}$ against $x_1$ and $x_2$ one may see that whether $\dot{V}$ be positive or negative depends upon the value $\varepsilon$ takes. For example, there exists $x$ which gives $\dot{V} > 0$ when $\varepsilon$ is 1.7 and 0.08, while if $\varepsilon = 0.3$ then $\dot{V} < 0$ for all possible values of $x$.

The original system (Equation 5) has the eigenvalues at $\lambda_1 = 0$ and $\lambda_2 = -12.5$, with the corresponding eigenvectors at $v_1 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ and $v_2 = \begin{bmatrix} -0.0797 \\ 0.9968 \end{bmatrix}$ respectively. The system is linear since $A$ is a constant matrix and does not depend upon $x$. Also $A$ is not a stability matrix since the condition $\operatorname{Re}\lambda_i < 0$ is not satisfied. The equilibrium point at the origin is not unique as it has already been pointed out earlier that every point on the $x_1$-axis is an equilibrium point. The $x_1$-axis is a nontrivial null space of the matrix $A$. The change of variables $z = M^{-1}x$, where $M = [v_1 \quad v_2] = \begin{bmatrix} 1 & -0.0797 \\ 0 & 0.9968 \end{bmatrix}$, leads to $M\dot{z} = AMz = \begin{bmatrix} 0 & 0 \\ 0 & -12.5 \end{bmatrix}$, and therefore $A = \begin{bmatrix} 0 & 0 \\ 0 & -12.5 \end{bmatrix}$. The solution

to this system is $\dot{z}_1(t) = z_1(0)$ and $z_2(t) = z_2(0)e^{-12.5t} = z_2(0)e^{\lambda_2 t}$. That $A$ is no stability matrix can be seen by trying to solve the Lyapunov equation $PA + A^T P = -Q$, where $Q$ is a positive definite symmetric matrix. The Lyapunov equation for this system yields no solution.

From simulation results, when $\varepsilon < 0$ the controlled system is unstable, while for $\varepsilon > 0$ increasing $K$ will widen the range of $\varepsilon$ in which the controlled system is stable. That is, the larger the value of the gain $K$ of the control input, the more robust with respect to $\varepsilon$ this control scheme.

Note also that one way to stabilise the origin of the system is to solve the equation $A^T PE + E^T PA - (E^T PB + S)R^{-1}(B^T PE + S^T) + Q = 0$, or equivalently $F^T PE + E^T PF - E^T PBR^{-1}B^T PE + Q - SR^{-1}S^T = 0$, where $F = A - BR^{-1}S^T$, $Q$ and $R$ are symmetric positive definite matrices, and the system is written in the form $E\dot{x} = Ax + Bu$. For example, letting $Q = R = E = I$ and $S = 0$ leads to $P = \begin{bmatrix} 12.62 & 1 \\ 1 & 0/1194 \end{bmatrix}$. The feedback input is then $u = -Gx$, where $G = R^{-1}(B^T PE + S^T)$. The gain matrix will be $G = [1 \quad 0.1194]$. Then the closed loop eigenvalues can be computed from $(A - BG)V = EV\Gamma$, where $V = [v_1 \quad v_2]$, $\Gamma = \begin{bmatrix} \lambda_1 & 0 \\ 0 & \lambda_2 \end{bmatrix}$, $\lambda_i$ is the $i^{\text{th}}$ eigenvalue, and $v_i$ its corresponding eigenvector. In solving the Riccati equation the Frobenius norm of the relative residual matrix is $3.14 \times 10^{-16}$. Simulations on Simulink show that when $\varepsilon = 0$ the system is unstable. There exists a domain of attraction outside which the trajectory does not converge.

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# On the Present Simple Tense

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Let us recall the time when we were children and were taught our first lessons on English grammar. The first thing that we learnt at that time was possibly about the Present Simple Tense. After that, the next lesson was usually about the Present Continuous Tense. I remember thinking at that time that the Present Continuous Tense was unnecessarily coined up, since we have already got the Present Simple Tense. Why having two Tenses instead of one, when, obviously, both of them are trying to describe the same thing? Moreover, what is going on at present must still be in the course of action, therefore it can be considered as being continuous anyway, isn't it? ...Is it? ...Really? To see whether this is, let us have another look at this so-called Present Simple Tense and see whether it is as simple a thing as its name implies. Let us even forget its name for a while, if we have to, in order not to be alluded by its name into thinking that it must be easy. Because it is by no means so.

First of all, let us imagine one situation (Khitapanna) as a case study. Imagine yourself driving along a road when a friend, who is sitting next to you, happened to mention out loud, "I see a white car before me.". The question is whether the sentence is correct. The answer could be either yes or no. If the answer were yes, however, then it is possible that this person has got some serious troubles with his mind. What he is actually telling is that he sees one white car there in front of him all the time, no matter what he may be doing, and despiting the fact that there may not even be any such car there (even if there was one there, the sentence will still have the above meaning). This is equivalent to the state of hallucination, or to the state of mind of a drug addict who has just taken a considerable amount of dose. So if this person is really your friend, then the answer had better be no. If the answer is no, then yet another question arises, "What is wrong with it, then?". The problem with this sentence is simply the fact that it is written with the Present Simple Tense. This Tense invariably, if not always, describes facts, things, or conditions which is true at all time. It does not represent things which occur at that moment and, unless some kinds of limits were used in order to reduce this vast span in time, is always timeless. But if something is always true, then it

must also be true at present as well. The truth at the point at present is only an implication from the larger, universal truth. This is the reason why we must have the Present Continuous Tense, not as being a redundancy, but as being a necessity. It describes what is going on at the moment, has got both a starting point which is not very far back into the past, and has got an end point which is not so far away into the future. Notice that, had the former sentence been *seasoned* with either an auxiliary verb or an adverb of time, for example "I *can* see a white car before me.", or "*Whenever* I see a white car before me, I *always* think of my old sport car which is kept in the garage.", then it would have been fine. In this specific case, since the continuous form is not possible for the verb *to see*, the only way possible is by using an auxiliary verb as we have done. Without any modifier of verb to indicate the frequency, the Present Simple Tense always describes facts.

This the same reason why we say, for example "I have got a girlfriend.", and not simply "I have a girlfriend.". The last sentence would only have been true if this girlfriend had been there since the time that you were born, never turns into being your wife, never leaves you, and is certain to outlive you. Somehow to have every one of these conditions at the same time seems a little bit unlikely, doesn't it? Again, this example shows that the first sentence is not unnecessary, but is rather important. The second one, had it been a sentence in a computer programme, would surely have caused a syntactic error (that is the compiling of the programme stops, giving an error message or error messages), a semantic error (that is the programme could be compiled, though it may produce funny results once run, since it obviously has got a major erroneous assumption), or both.

The Present Simple Tense is difficult to use and could easily lead to a totally different meaning to the intended one. For this reason, it is seldom found without an auxiliary verb. But whenever it is purposely used, it can produce such an indescribable effect that is only possible through its conciseness, seriousness, and many more other things implied. An example to this, taken from a song written by a rock band called *Michael learns to rock*, would be this well-written sentence, "I see your face before my eyes as I lay on my bed.". To a listener who notices the implication, it would mean much more than a full page trying to describing the same condition. This is a condition of one being very obsessed in infatuation. What double the effect on listeners is the innocence of this character described in the song, which is affected by the conciseness of the sentence, not saying any more than what is necessary. The sentence essentially tells us that whenever this person lies on his bed, he always see the face of his lover before his eyes (even with his

eyes closed!). A step further, and this would surely become madness. If the sincerity in this sentence is conveyed by its shortness, then the seriousness of it must have been implied by the actual presence of the Present Simple Tense which produces, as we have discussed, an effect of being everlasting, and thus severe.

# Book Introduction

## A Kiwi Lanna

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I was lucky to have become a part of the *saṃnakd́aḅ* (sword school) Śrị Ȧyudhyạ and I am lucky to be here in New Zealand studying the sixth form. The former experience has taught me compassion, the latter how to do research. This last one is basically how to read and write. To read and write is not difficult, but to know *how* to do so that is another thing. It amounts to knowing how to think for yourself. Now I know, for instance, that good books always have two themes, and the more profound one is always the one in the background, a more abstract one and never a story. This is why it is always difficult to turn these books into a film where you can only show the less important theme and it is nearly impossible to express the remaining one. I learn all this in my Sixth Form English class here. Night and day I recite lines from Macbeth. Before I came here I had read Julius Caesar, but this is by far better. Not only this, I also study Art History, Mathematics and Music. Now I am a writer, thanks to Mr Lonsdale my English teacher then. I am also a mathematician, thanks to Mr Thompson who taught me the subject. I can not wait to become an artist and a composer which are what the other two of my teachers, the latter of whom is Vicky, had taught me to be. In this book, however, I only talk predominantly about literature.

# Book Introduction

# A British Lanna

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It is England which turns me into a Christian. This is by no means a compliment to the country, but it certainly is one for the people. At the Moberly Hall where I live I read the translation of Hugo's Les Misérables, the book which greatly moves me and even before having been through the whole of it had made me profess Christianity. And here is my interpretation now, that God is the Superset. Therefore, if we believe in the one and only one Creator by definition we have Christ in our heart but mathematically speaking we are the Me in Christ in the Universe in God. Here I say Christ as a definition as distinguishable from Jesus who is also a person. A similar definition to the one above, and which is what I prefer now, is this, that it is instead a Me in Universe in Christ in God. It is easy to see from this, that we should explore the universe because they are the same family as ours. In other words they are one of us, though they may not know it, so we need to find and preach the Gospel to them. England and my teachers here have taught me many thing. It is also here that I volunteer in the Community Action and through it got to know Clair. But I had better leave you to read about her yourself.